ORIGINAL ARTICLE

What can analysis of 47 million job advertisements tell us about how opportunities for homeworking are evolving in the United Kingdom?

Julia Darby[1] 🟢 | **Stuart McIntyre[1]** 🟢 | **Graeme Roy[2]** 🟢

[1]Department of Economics, University of Strathclyde, Glasgow, UK

[2]Department of Economics, University of Glasgow, Glasgow, UK

Correspondence
Julia Darby, Department of Economics, University of Strathclyde, Glasgow, UK.
Email: julia.darby@strath.ac.uk

Funding information
Economic and Social Research Council

Abstract
Using an extensive database of job adverts, we investigate the extent to which homeworking is likely to continue. We track how advertisement language has evolved to indicate homeworking opportunities and how the characteristics of jobs offering these opportunities have changed, including a greater degree of polarisation in opportunity by salary.

1 | INTRODUCTION

There has long been interest in the growth of homeworking and different forms of flexible working more broadly (Felstead, 2022). The onset of public health restrictions in March 2020, and specifically 'stay at home' and 'work from home' (WFH) restrictions, gave many people their first experience of significant periods of homeworking. As restrictions have been introduced, strengthened, relaxed, strengthened again, and eventually removed, businesses have been revisiting and adapting working practices. The pandemic showed that unprecedented numbers of workers could work at home when necessary. Survey evidence suggests that many workers and some employers would like to move to a hybrid pattern of working if it can have lasting impacts upon productivity and wellbeing (e.g., Bloom et al., 2021; ONS, 2021a; Taneja et al., 2021; Taylor et al., 2021).

Emerging from the pandemic, and as 'work at home' guidance is unwound, a key unknown is the degree to which the shift to working at home witnessed over the last 2 years will remain a feature of our labour market. The extent to which working at home remains a significant labour market characteristic will have implications for a range of economic and social issues from productivity, wellbeing, inequalities, housing, the future of city and town centres, and demand for public transport (see, e.g., Felstead, 2022).

In this study, we investigate how business recruitment practices, as reflected in job adverts, have evolved since March 2020 compared to the immediate pre-pandemic years and assess what the data—as we emerge from the pandemic—reveal about future trends concerning workplaces and work practices. By examining job adverts we provide an insight into the opportunities on offer from employers, in particular how they signal working conditions that will apply into the future. Employers engaged in the costly exercise of recruitment, through the kinds of employment opportunities they offer, provide clues about their expected future labour needs. In short, analysis of detailed job vacancy data enables us to offer new insights into how prevalent some form of homeworking is likely to be in the future.

Using a database of online UK job adverts from January 2018 to January 2022. In total, our analysis considers over 47 million job adverts posted online, covering all sectors of the economy. We apply textual analysis techniques to identify phrases associated with homeworking, remote working, telecommuting and hybrid working. We go further than looking at the total number of vacancies advertising homeworking as others have done (e.g. Draca et al., 2021; ONS, 2021b) by tracking the frequency with which adverts refer to each of seven categories of terms associated with homeworking and looking at the opportunities by job characteristics, including the type of job, salary, and geographical location.

Our analysis confirms earlier findings that both the number of job adverts and the extent to which these refer to opportunities for homeworking have increased since the initial drop in hiring activity in the early stages of the pandemic. Our contribution however, is to unpick these findings in several dimensions which have not, to our knowledge, been explored before. We make four new contributions. First, by using monthly data to track the language used in job adverts relating to homeworking, we identify some clear changes; in particular, an upward trend in references made to hybrid working as the experience of homeworking has become more normal for many. Second, our analysis of job opportunities by location reveals a picture of common trends toward homeworking across the United Kingdom, in broad terms, but with some spatial variation. Most notably, London saw a slower recovery in the number of job adverts for a protracted period. Third, when looking across all adverts offering opportunities for homeworking, we find particularly high concentrations within a limited range of job categories. The largest concentration of such adverts is for IT roles; and a growing proportion are for Accounting and Finance roles, for example. On the other hand, the full extent of the jump up in Customer Services job adverts offering homeworking opportunities early in the pandemic has not been sustained. Finally, we demonstrate that the rise in mention of opportunities for homeworking has become more concentrated in job openings that offer salaries toward the top end of the pay distribution, suggesting a widening degree of polarisation of homeworking opportunities in the labour market.

The structure of the study is as follows. Section 2 provides a short overview of the relevant literatures. Section 3 provides details of the data set and methodology employed and presents some insights on trends in job advertisements during the pandemic. Section 4 presents findings from our analysis of the features of job adverts that speak to the potential longevity of trends in homeworking. Section 5 concludes.

2 | LITERATURE REVIEW

A shift to working at home has been predicted for a long time in both the academic and policy literature (see, e.g., Lees, 1999; Scase, 1999). Progress, however, has been slow despite reforms to support flexible working and the adoption of digital technologies. In the United Kingdom, Felstead and Reuschke (2020) show that the percentage of workers reporting that they were 'working mainly at Home' only increased by around three percentage points to five percent of the workforce in almost 40 years. Similar findings have been observed in other countries, including Japan (Morikawa, 2018), the USA (Barrero et al., 2021; Mateyka et al., 2012) and Canada (Mehdi & Morissette, 2021).

The Covid-19 pandemic turned such trends on their head. At the height of the lockdown in April 2020, over 40% of UK workers were working from home (Felstead & Reuschke, 2020). Similar trends were evident in the United States and major European countries, with between 35% and 50% of all workers working at home (Bick et al., 2020; Brynjolfsson et al., 2020; Buchheim et al., 2022). Of course, not all jobs can be undertaken from home. The ease with which jobs can feasibly be undertaken from home varies by sector and task (Adams-Prassl et al., 2022; Dingel & Neiman, 2020; Mongey et al., 2021). This makes it essential to consider these trends by looking at disaggregated data by sector and/or occupation.

There remains uncertainty about how much the changes in homeworking seen through the pandemic will 'stick'. Studies like Dingel and Neiman (2020) have estimated that—in principle— nearly 40% of jobs 'could' plausibly be performed at home. The percentage varies significantly by job type, wage, and experience. Bloom et al. (2021) identify a demand from employees for hybrid working arrangements. In their survey-based analysis, only 18% of UK employees rarely or never want to work remotely, while approximately 82% would like to do so at least one day per week. Similarly, 78% of US employees that can work at home would like to continue doing so at least 1 day per week, with 31% of survey respondents reporting that they would like to work at home every day (Barrero et al., 2021). Haskel (2020) predicts that working at home will be more common than before Covid-19, although less common than at the height of the pandemic. Much will depend upon the emerging evidence, set out below, on how the significant period of extensive homeworking we have experienced is linked to better or worse outcomes for employers and employees.

Unsurprisingly, research into the impact of the rise in homeworking during Covid-19 on different individual and firm-level outcomes remains in its relative infancy. Given the scale of the economic shock over the last 2 years, it can be challenging to separate observed—or perceived—changes in outcomes arising from homeworking vis-à-vis other economic and social changes arising from the pandemic. The focus so far has included the effect on macroeconomic outcomes (Barrot et al., 2021), inequalities (Bell & Blanchflower, 2020), and the likely spatial distribution of economic activity (O'Connor, 2020). There has also been some emphasis on productivity and wellbeing (OECD, 2020).

Several theories before the pandemic suggested that a rise in homeworking might negatively affect productivity through losses from reduced 'learning by participation' (Sfard, 1998) and trust-building (Jarvenpaa & Leidner, 1999). Others pointed to possible positive impacts. Social exchange theory, for example, might generate reciprocity (Cropanzano & Mitchell, 2005), thus supporting greater effort whilst working away from a noisy office environment (Dutcher, 2012), all might boost productivity. Such benefits are thought to accrue in addition to any efficiency savings from reduced commuting times. Empirical evidence on which effects are likely to dominate is mixed. Bloom et al. (2015) found positive effects on productivity for workers at a

call centre, with a 13% improvement in performance for those able to work at home. After the experiment, over half of the workers chose to switch to homeworking. The majority of uplift in productivity stemmed from a rise in the extensive margin (i.e., fewer breaks and sick days), with around 1/3 of the improvement from greater efficiency on the job (attributed to a quieter working environment).

In contrast, Battiston et al. (2021), exploiting a natural experiment within a public sector organisation in the United Kingdom, found the opposite: face-to-face working increased productivity. In part, the difference in findings appears to reflect variations in the complexity of tasks across experiments. Dutcher (2012) concluded that telecommunications might have a positive impact on the productivity of creative tasks but a negative impact on the productivity of dull tasks. One limitation of this literature is that it focuses upon productivity effects within select occupations. However, we know that the Covid-19 outbreak dramatically increased the prevalence of homeworking in almost all occupations. This makes postpandemic evidence essential.

Felstead and Reuschke (2021), drawing upon detailed data from the UK Understanding Society Covid-19 Study, found most employees reported that their productivity had improved or stayed the same despite the shift to working at home. Only around one in six homeworkers reported a fall in productivity. The same patterns—increasing home-working and not much change in workers' average productivity—were also found in studies of employees in Europe and the US (see, e.g., Brynjolfsson et al., 2020). However, Morikawa (2020) reports results of a survey of employees in Japan that finds home productivity was about 60%–70% of that achieved when working at the usual workplace, with greater losses reported by new 'homeworkers'. Etheridge et al. (2020), using the same data set as Felstead and Reuschke, seek to explain heterogeneities in self-reported productivity by workers' characteristics (gender, income, childcare, etc.) and job characteristics (industries and occupations) and found workers in industries and occupations typically less suitable for working at home reported lower productivity relative to before the pandemic. Adams-Prassl et al. (2022) found that productivity impacts from homeworking are affected by socioeconomic conditions, with particularly strong negative impacts upon women with children *within* occupations and industries.

There is an evidence base emerging on how homeworking has impacted individuals themselves. A large sample of data published by the UK Office for National Statistics (ONS) on self-reported well-being found no appreciable difference between those currently working at home and those not working from home (ONS, 2021c). But there is some evidence of a negative impact on mental health (Banks & Xu, 2020; Oakman et al., 2020; Proto & Zhang, 2021). Etheridge et al. (2020) link the deterioration of workers' mental health during the Covid-19 period with changes in their productivity. Workers who stated that they have difficulties performing their jobs, and get much less done, at home reported decreases in mental health, similar to the effects of an unemployment shock. Another channel through which homeworking has affected individuals is by making it more challenging to manage their work-life balance (Palumbo, 2020).

In contrast to studies looking at *employee* experience, Haskel (2020) looks at the productivity impacts of this period of widespread homeworking from the perspective of *employers*. Drawing upon the ONS' Business Insights and Conditions Survey, he concludes that most employers have reported a decline in productivity following a shift to working from home and that this conclusion is consistent across sectors. This aligns with evidence for the US reported in Bartik et al. (2020). That is not to conclude that productivity declines are inevitable. Eberly et al. (2021), for example, argue that any hit to productivity from working at home can be buffered against to some extent by the deployment of 'potential capital'—the dwelling/ residential capital and connective technologies used alongside working from home.

Having set out what is already understood about the nature and changes in homeworking through the pandemic, the following section provides details of the database we use to analyse trends in homeworking in the United Kingdom in this study.

3 | DATA AND METHODOLOGY

3.1 | The Adzuna data set

The data set we use is provided by Adzuna through the Urban Big Data Centre at the University of Glasgow[1]. Adzuna, founded in 2011, provides an online job search engine that collates job advert information from several thousand sources. The sources used include employers' websites, recruitment agencies, and traditional job boards. Adzuna achieves high coverage of all job adverts in the United Kingdom and has expanded to collate vacancy information and provide job search engines for several other countries. Within the United Kingdom, Adzuna won a UK government contract to provide the Department for Work and Pensions' Find a Job service in 2018. Since 2020, Adzuna has been collaborating with the United Kingdom's ONS. This collaboration has supported the ONS to develop experimental vacancy statistics using the Adzuna database, and further refinements to these series are planned (ONS, 2021b, 2021d).

For our purposes, a key advantage of using a data set of job adverts is that it provides a picture of the opportunities on offer from employers that signal working conditions now and into the future. Hiring is 'a costly, forward-looking investment in human capital and... reflects managers' expectations about their companies' future', Campello et al. (2020). Job adverts are key forward-looking indicators of labour demand. Those entering into new employment contracts are among the employers and workers who will likely lead changes to previous contractural norms. In contrast, looking at figures that simply tell us how many people are currently working from home at a given point in time does not provide a signal on the expected future conditions of work. A further advantage of this large job advert data set over surveys of employers' and/or workers' attitudes is that we can scan millions of contemporary job adverts. In contrast, the samples involved in surveys are much smaller. Also, even if the surveys are repeated, they cannot provide the basis for the detailed analysis of month-on-month changes we offer.

The specific data set we explore provides information on online job adverts that were live in the last week of each month from January 2018 through to January 2022. This gives 49 separate monthly data extractions, which combine to provide a data set of more than 47 million job adverts. The variables Adzuna provide in the database include the *job title* and *job description* from each advert and the associated 'raw' location; these are each free-text fields completed by the company or individual creating the job advert. Adzuna use the raw location field to match each job to a potentially multi-tiered location variable. We use Adzuna's *location* variable to associate each job advert to the appropriate UK Government Office Region (GOR). In cases where no mapping at the level of GOR is feasible, for example, when Adzuna found the raw location information was missing, the location is simply recorded as United Kingdom.

Each advertised post is also allocated to a *job category* by Adzuna. Since mid-2019, Adzuna has used a neural network-based machine learning model to allocate each job advert to an

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[1]Adzuna. Economic and Social Research Council. Adzuna Data, 2022 [data collection]. University of Glasgow - Urban Big Data Centre.

appropriate job category; before this, the category was mapped from the source data for each advert. Their current approach results in far fewer 'unknown' entries.[2] For the purposes of our current study, we stick with Adzuna's allocated job categories. The data set also includes salary information. In some cases, the actual salary or salary band is included within the advert, but coverage can be patchy. Instead, the information we use is the *predicted salary* that Adzuna provides for every job; this is calculated by using a maximum likelihood model, which takes into account information on keywords from the job title, job description and the company name, amongst other things. Finally, the database includes the *date* of extraction of each advert.

3.2 | The impact of the Covid-19 pandemic on the number of online job adverts

The Adzuna data enable us to track online job adverts recorded from January 2020 through to January 2022 and compare with the average numbers of adverts recorded each month in the 2 prepandemic years; as shown in Figure 1. The bar representing the total number of vacancies in a given month is subdivided into those that mention opportunities to WFH and those that do not, further discussion of this distinction is postponed to Section 3.4.

That Covid-19 led initially to a substantial decline in vacancies is evident in all vacancy datasets[3]. At the same time, UK economic activity, as measured by Gross Domestic Product, fell over 20% from peak to trough at the start of the crisis. The Adzuna data records a 25% drop from the prepandemic peak of 0.92 million online adverts in February 2020 by the end of March 2020. Almost 60% fewer vacancies were advertised online in the last week of May relative to February of 2020. The recovery began in June 2020, as government-imposed restrictions aimed at reducing the transmission of infections eased. There were further setbacks when restrictions tightened again, evident at the start of the second national lockdown in late December 2020. The number of online job adverts surpassed the immediate prepandemic peak by the last week of April 2021. The June 2021 figure of over 1.21 million vacancies is some 25% above the prepandemic peak of 0.92 million and 11% above the average level reached in the same week of June in the 2 years before the pandemic (1.13 m in June 2018, 1.06 m in June 2019). At the end of our time span, vacancies remain strong relative to the 2 prepandemic years but dip, partly due to the usual seasonality, though probably exacerbated by the Omicron variant. A peak of 1.22 m vacancies was reached in November 2021, 33% above the average reached in November of 2018 and 2019.

3.3 | Regional differences in the impact of Covid-19 on the number of job adverts

The location information Adzuna extract from the job adverts enables us to attribute the vast majority of the vacancies to the Government Office Region in which the jobs will be located. Figure 2 shows that similar patterns are visible for England and the UK's Devolved Regions

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[2]The ONS has announced plans to develop their indicators that use Adzuna data to produce further breakdowns including online vacancies by Standard Occupational Code, see ONS (2021b).

[3]At the aggregate level, ONS (2021b) find a strong correlation between Adzuna job advertisement data and the ONS vacancy survey.
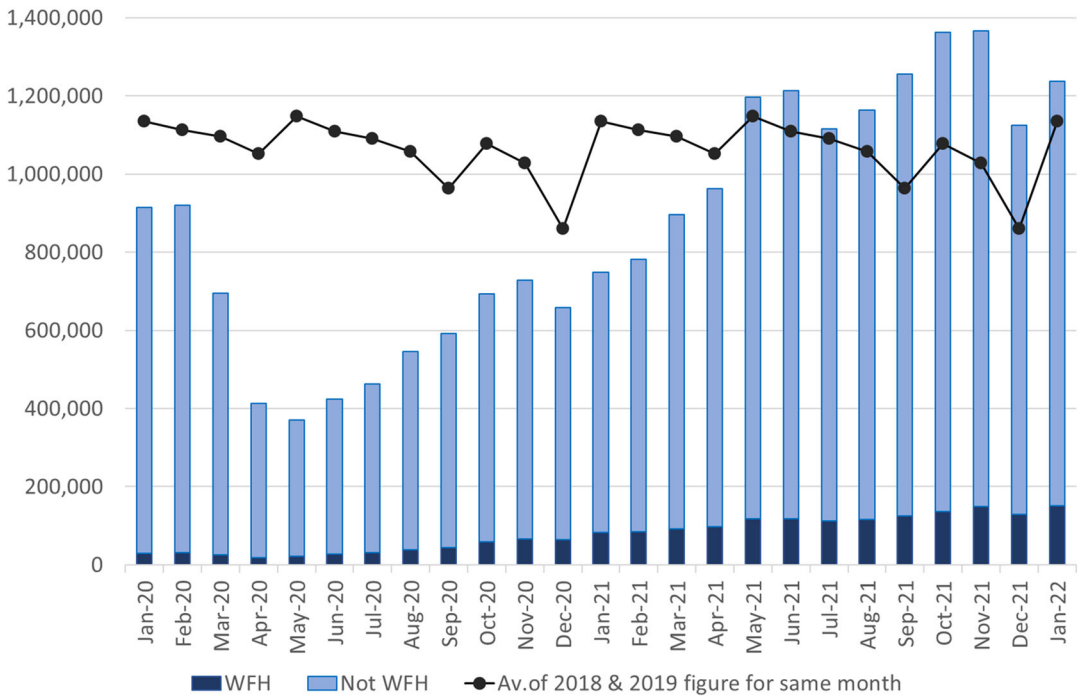
FIGURE 1 Total number of online job vacancies recorded in Adzuna Data. We substituted data from the first week of January 2020 for the snapshot we date as December 2019 since Adzuna faced technical issues that meant snapshots taken at the end of December 2019 failed.

(panel A) and across English regions (panel B). Interestingly, there are bigger differences between some English regions than across the UK's devolved regions.

The data show that online adverts for jobs located in the North East of England recovered to prepandemic levels first, in October 2021. Northern Ireland followed in January 2021; most other English regions crossed this threshold in March 2021. Scotland, Wales and the remaining English regions, with the sole exception of London, passed this landmark in April 2021. That is, by April 2021, London was the only region to still see fewer online job adverts than in February 2020. By June 2021, in all but one region (London), Adzuna recorded numbers of online vacancies at least 25% above prepandemic levels. The recovery picks up pace again from August to November 2021, with Scotland and Wales ahead of Northern Ireland and England and the North East experiencing the greatest gain of any Government Office Region. While London has been something of a laggard, the January 2022 figure is 42% above the prepandemic peak.

3.4 | How we identify and track trends in WFH opportunities in Adzuna data?

On 14 June 2021, the ONS published a one-off data set on the proportion of Adzuna's online job adverts that offered home working opportunities, see ONS (2021d). We base our approach for identifying home working opportunities on theirs, outlined in ONS (2021b) and related work by Draca et al. (2021), but with a few refinements. Similar approaches to creating quantitative data from searching the text of job adverts have been used in different contexts by Bai et al. (2021),
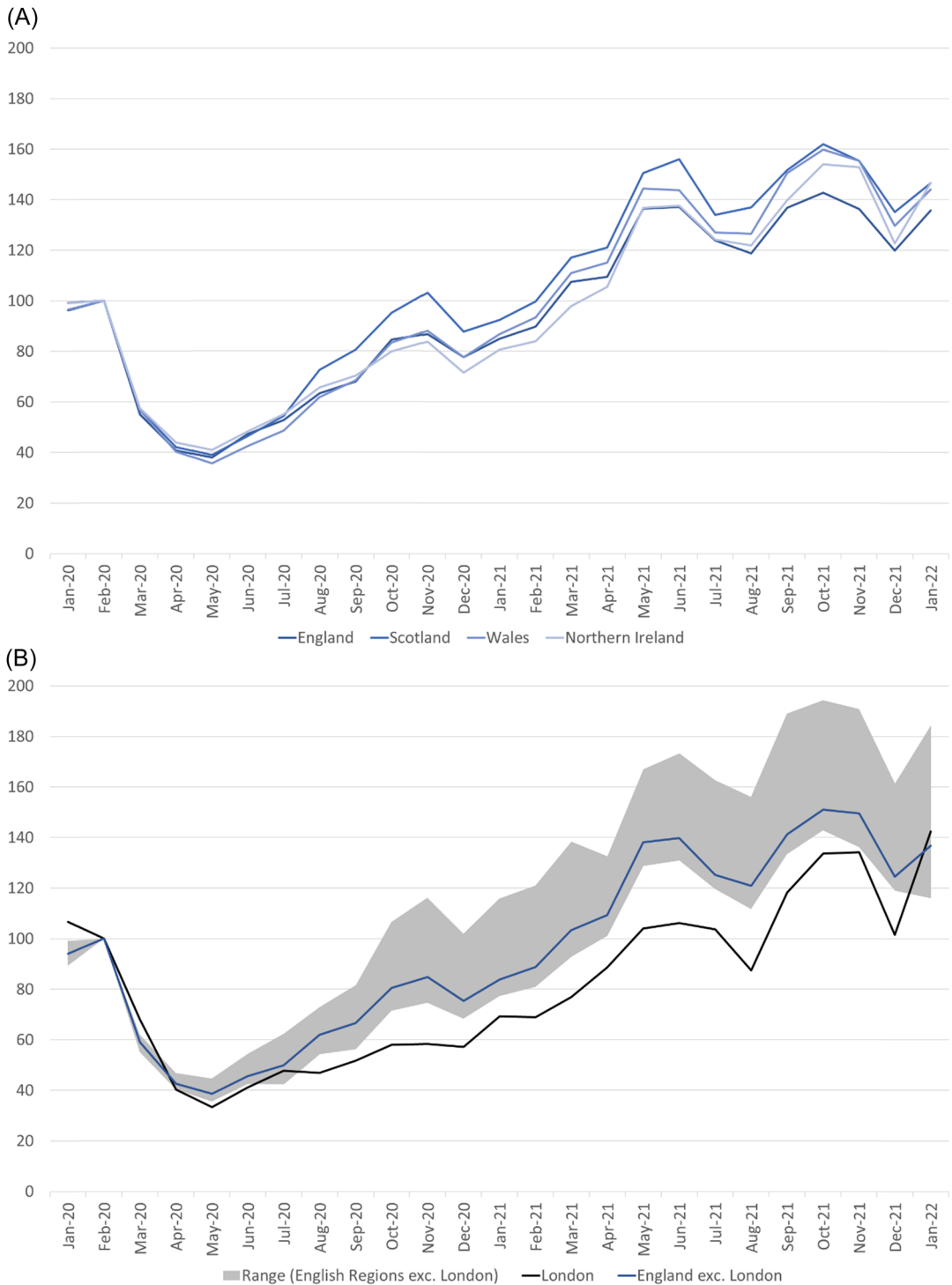
(A)

(B)

FIGURE 2   Total number of online job adverts by region. (A) Number of Online Job Adverts in England & Devolved Regions. (Index Numbers, February 2020 = 100). (B) Number of Online Job Adverts in English Regions (Index Numbers, February 2020 = 100).

Lassébie et al. (2021) and Turrell et al. (2021), among others. Like these authors, we first convert the text of each *job description* to lower case and remove unnecessary punctuation. We then apply a text-matching algorithm to identify those adverts that include key phrases associated with home working in the text of the job description.

Following Draca et al. (2021), who used a similar data set from Burning Glass Technologies, we search for key phrases found at https://timewise.co.uk and in the official definition of flexible work arrangements by the Advisory, Conciliation and Arbitration Service (ACAS) and complement this vocabulary complemented with other expressions identified via a data-driven approach in the job adverts. We consolidate the key phrases into seven categories: those relating to 'WFH', 'remote working', 'home based', 'home working', 'teleworking', 'virtual job' and 'hybrid working'. We apply corrections to ensure we do not wrongly identify adverts that refer to 'nursing home', 'care home' or 'residential home' as offering opportunities to WFH, and additional corrections ensure that we don't pick up adverts that state jobs are 'unsuitable for' or 'not suitable for' home working. Further details are provided in Appendix A.

We classify a given job advert as offering an opportunity for working from home, WFH = 1, if at least one of the key phrases is used in the text of that job advertisement. Draca et al. (2021) illustrated the breakdown of the key phrases used to classify vacancies as WFH opportunities in a bar chart, but they only showed annual averages over 2017–2020. The time span covered by our data set allows us to monitor changes over time in the frequency with which each category of phrases associated with homeworking is used, allowing us to track how the WFH terminology used in job adverts has evolved during the pandemic.

Our findings are summarised in Figure 3. The dates on the horizontal axis relate to the Adzuna snapshots for which we have all live online job vacancies (from January 2020 onwards). The snapshots are those taken in the final week of each month. The lines plotted relate to all job adverts at each point in time that included key phrases relating to WFH; these phrases are grouped into seven categories. The height of each line represents the percentage of the adverts offering WFH opportunities mentioning the relevant set of key phrases. The percentages do not add up to 100 at each date; this is simply because many of the adverts include key phrases from more than one of the categories.

Unsurprisingly use of the phrase 'WFH' in job adverts grew during the early stages of the pandemic. The emergence of phrases such as 'unsuitable for home/remote working' during 2020, the continued growth in references to 'remote working' through early 2021, and particularly the clear growth in references made to 'hybrid work' since April 2021 demonstrate how the terminology used in the job adverts is evolving. A key strength of our data set is that it enables us to look at this. After instigating a search for 'virtual job,' we found we needed an additional correction to prevent misclassifying several recent adverts that required potential candidates to watch a 'virtual job preview' before applying. 'Virtual job' seldom appears. Older terms related to teleworking and telecommuting look to be vanishing from use in the United Kingdom.

4 | EXPLORING THE POTENTIAL TO GAIN INSIGHTS INTO THE LONGEVITY OF EMPLOYERS' WILLINGNESS TO OFFER WFH OPPORTUNITIES USING ADZUNA'S DATA

In the prepandemic months of our sample, fewer than 3% of all job adverts mentioned opportunities to WFH. In 2020, many of those who began working from home for the first time did so primarily due to the imposition of government WFH directives and/or guidance, not
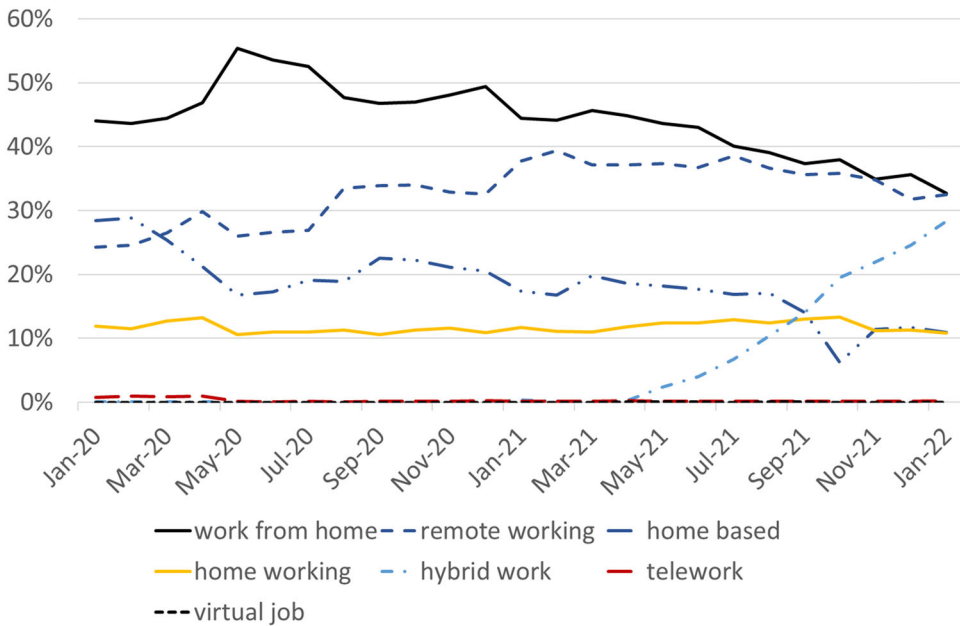
FIGURE 3 Tracking trends in the terminology used to refer to WFH opportunities in job advertisements.

through the unconstrained choice of the workers or their employers. The pandemic-related restrictions forced a rapid pace of change, bringing about a shift far greater than before, even after decades of policies intended to encourage greater use of flexible working practices. See Bai et al. (2021) for a discussion of the unanticipated shift and Brynjolfsson et al. (2020), who assert that lasting changes should be expected given that so many businesses and individuals have tried out new approaches and invested in the fixed costs of enabling remote working, including technology, human capital and organisational processes; they may decide to stay with the new methods, particularly if these have been unexpectedly efficient or effective. Beatson (2019) and Pyper (2015) discuss past policies aimed at encouraging more opportunities for working from home, which were far less effective.

The fact that our sample continues to January 2022 means that we can gain further insights into whether there look to have been lasting shifts in the willingness of employers to offer a wider range of prospective employees opportunities to WFH as government restrictions ease. As discussed in Section 2, surveys of workers' preferences indicate that many (though not all) workers want to retain some opportunities to WFH. In contrast, the available employer surveys indicate mixed views on this.

4.1 | How many and what percentage of online job adverts offer the opportunity to WFH?

The share of online job adverts that include reference to the possibility of working from home averaged 2.8% and did not exceed 3.3% in any month over the whole prepandemic period for January 2018 to February 2020. The percentage grew consistently from May 2020 to June 2021. By January 2021, WFH was mentioned in 11% of all online job adverts. Once the total number

of adverts surpassed their prepandemic level, from April 2021 onwards (see Figure 1), the percentage of online job adverts offering WFH opportunities settled at around 10% of the total, with the number of job adverts offering WFH opportunities reaching a local peak in excess of 118,000 at the end of June 2021, before dropping to 113,200 at the end of July 2021. The June 2021 figure represents almost a fourfold increase (3.89) in the number of online job adverts offering the opportunity to WFH relative to February 2020. The number of vacancies grew from August to November 2021, and following a dip that is likely to be partly seasonal but also influenced by the emergence of the Omicron variant of Covid, reaches a new high of 165,364 advertised vacancies offering WFH opportunities (14.5% of all vacancies) in January 2022 (Figure 4).

4.2 | How has the number of job adverts offering opportunities to WFH increased since the imposition of Covid-19 restrictions requiring people to WFH where possible?

In the United Kingdom as a whole, the number of job adverts mentioning WFH opportunities has increased by a factor of 5.4 between February 2020 and January 2022, from 30,397 to 165,364. Figure 5 provides a regional perspective on this. Panel (A) shows that the devolved regions of Scotland, Wales and Northern Ireland recorded a greater increase in job adverts offering WFH opportunities than England as a whole. That the line in panel (A) for Northern Ireland remains above that for England, Scotland and Wales over the summer and autumn of 2021 probably reflects the fact that Northern Ireland's government did not remove the 'WFH
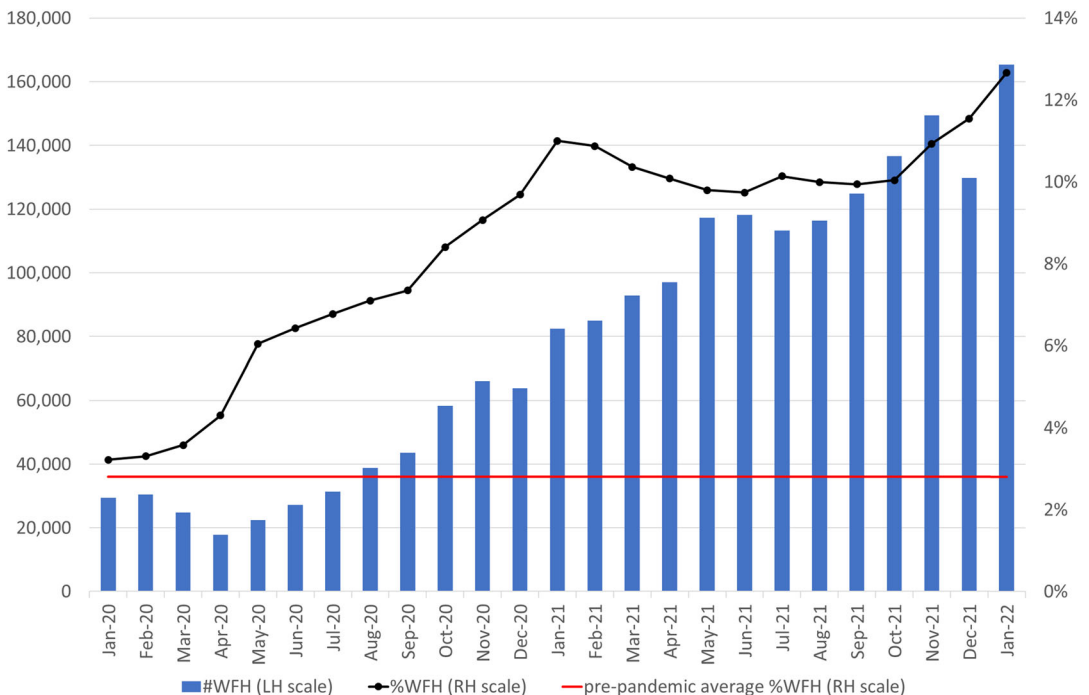

FIGURE 4 How many and what percentage of online job adverts offer the opportunity to WFH?
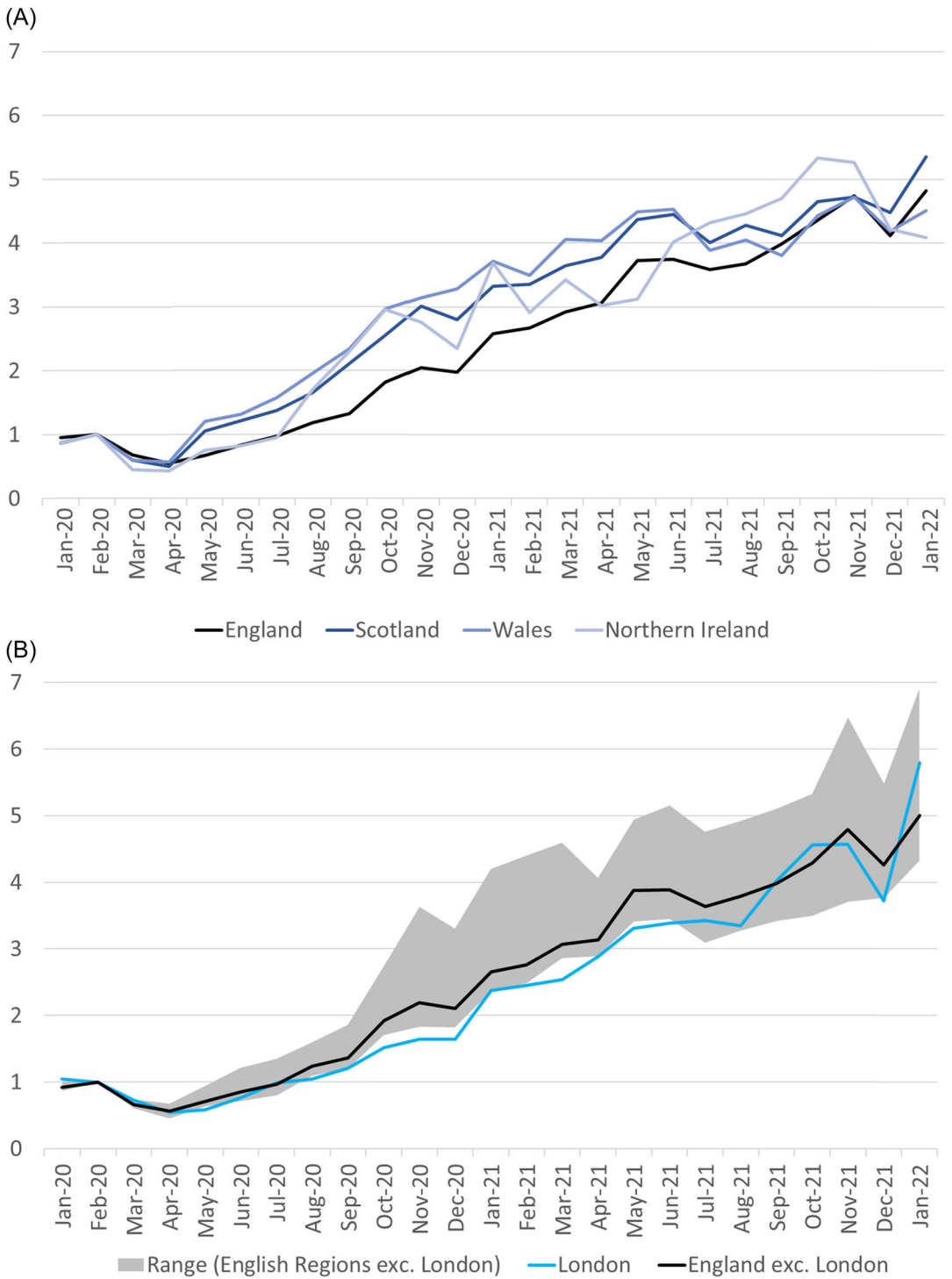
(A)

(B)

FIGURE 5 Multiples by which online adverts offering WFH opportunities have increased since February 2020, by region. (A) England, Wales, Scotland, and Northern Ireland. (B) English Regions.

where possible' guidance over this period once legal restrictions or guidelines stating that people should WFH where possible were lifted, which was the case between April 2021 and December 2021 for all UK regions except Northern Ireland, the upward trend looks to have stabilised somewhat. Among the English regions, adverts offering WFH opportunities increased by less in London than in other English regions, until after the 'WFH where possible' guidance was suspended but has not been dissimilar to the West Midlands and East Midlands from July 2021 onwards. An outlier is the North East of England which has consistently seen the largest multiples, represented by the upper edge of the shaded range; this region topped out with more than a sixfold increase over the February 2020 level by January 2022.

In the next section, we focus on how the prevalence of WFH opportunities differs across adverts by job category.

4.3 | What kind of job adverts offered WFH possibilities in the pre-pandemic period?

Given the small proportion of job adverts that mentioned WFH possibilities before the pandemic, in this section, we analyse a pooled sample covering (the final weeks of) January 2018 through to February 2020, giving a little over 80,000 adverts offering WFH opportunities. Analysis by job category reveals that IT jobs account for just over one-fifth of the total number of job adverts offering WFH opportunities, with Sales and Teaching jobs each at 11%, and Accounting & Finance and Engineering jobs at just over 5% of the total as detailed in Table 1. Looking more closely at the teaching job adverts reveals that those jobs offering WFH opportunities are mainly agency adverts for online tutoring, with relatively low predicted salaries (and low hours). The distributions of predicted salaries for these top five job categories are shown in Figure 6.

4.4 | The evolution of WFH opportunities by job category during the pandemic

IT jobs remain the most likely job category to offer WFH opportunities at every point in the data set, always making up over 30% of the total adverts offering WFH and as much as 40% in April 2020. When comparing January 2022 data with the immediate prepandemic data from February 2020, the number of job adverts for IT roles is 58% higher (at 181,419 relative to 114,927), and the number of these adverts offering opportunities to WFH has increased by a factor of 4.8 (from 10,674 to 51,508).

Accounting and Finance job adverts moved up the rankings from fourth at 5.5% in the prepandemic period, increasing to between 7% and 8% from April 2020 to December 2020, climbing to above 10% by June 2021 and becoming the second most likely job category to offer WFH opportunities, representing 11.3% of all job adverts offering WFH opportunities in January 2022. The number of adverts for Accounting and Finance jobs in January 2022 was 24% higher than in February 2020 (at 89,894 adverts relative to 72,442). The number of these adverts offering opportunities to WFH has increased by a factor of 9.1, that is, just over 900% (from 2053 to 18,736). It seems that opportunities for WFH, at least in the form of hybrid working, are likely to stick for this job category.

TABLE 1 Prepandemic distribution of adverts offering work from home (WFH) possibilities by job category

January 2018 to February 2020			
Rank	Job category	WFH (%)	Cumulative (%)
1	IT jobs	20.3	20.3
2	Sales jobs	11.1	31.4
3	Teaching jobs	10.8	42.3
4	Accounting and finance jobs	5.5	52.3
5	Engineering jobs	5.3	57.8
6	Public relations jobs	4.4	63.1
7	Trade and construction jobs	4.1	67.5
8	Legal jobs	3.6	71.5
9	Healthcare and nursing jobs	3.1	75.1
10	Admin jobs	2.9	78.2
11	Consultancy jobs	2.2	81.1
12	Customer services jobs	1.9	83.3
13	Other/general jobs	1.8	85.2
14	Scientific and QA jobs	1.8	87.1
15	Travel jobs	1.7	88.9
16	Social work Jobs	1.6	90.6

Note: The table includes only those job categories that each account for >1.5% of all online adverts mentioning WFH opportunities and together account for more than 90% of all the total number of adverts offering opportunities to WFH. Figures in the WFH% column indicate the number of adverts offering opportunities for homeworking in the stated job category as a percentage of the total number of adverts offering homeworking opportunities, regardless of job category.

Sales jobs have remained second or third in the rankings from the prepandemic period onwards and come in just behind Accounting & Finance, accounting for 10.2% of job adverts offering opportunities to WFH in January 2022. The number of adverts for Sales jobs was 22.9% higher in January 2022 relative to February 2020 (92,018 relative to 74,884), but the number of adverts offering WFH opportunities had risen by a factor of 3.6 (from 4655 to 16,874).

Table 2 provides information on the numbers of adverts by job category for the top 14 job categories when ranked by the number of adverts offering opportunities to WFH. The total number and the percentage of the total number of job adverts accounted for by each job category that offering WFH opportunities are recorded. The final column shows the cumulated percentages, indicating these 14 job categories together account for almost 90% of all adverts in January 2022 offering WFH opportunities.

In Figure 7, we show the distribution of predicted salaries for the five job categories revealed to have advertised the largest numbers of opportunities for WFH in January 2022 (in Table 2). The job categories are ordered in the Figure by median predicted salary. Except for Engineering jobs, those job categories that record the higher median salaries in job adverts also tend to be more likely to offer WFH opportunities (between 21% and 29% of job adverts), while the three categories with the lowest median salaries offer fewer WFH opportunities (in between 14% and 19% of job adverts).
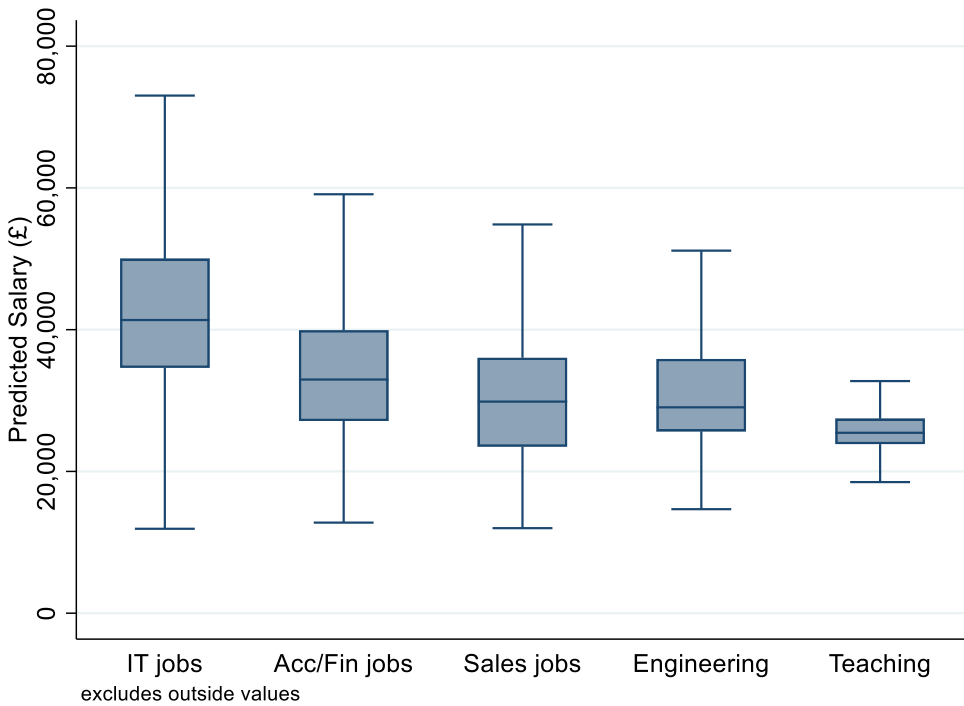
FIGURE 6 The distribution of predicted salaries for the five job categories that advertise the largest number of opportunities for WFH before the pandemic. (A) The figure is constructed using Adzuna's predicted salary variable. (B) The raw data covers all adverts offering WFH opportunities in the final week in each month from January 2018 to February 2020. The selected job categories are the five that have the largest number of job adverts offering WFH opportunities, and that together account for 57.8% of all adverts offering WFH opportunities in the period January 2018 to February 2020 (as indicated in Table 1). (C) The job categories (IT, Accounting & Finance, Sales, Engineering and Teaching jobs) are shown in order of median salary. The box plot for each job category indicates the median salary by the horizontal line drawn through each box. The upper and lower boundaries of each box indicate the 75th and 25th percentiles. The whiskers are scaled to extend two-thirds of the box width. Values outside the whiskers are not shown, nor are they used in the scaling of the vertical axis.

One further issue we explore is the correlation between the growth of homeworking and changes in the number of vacancies across different job categories. Might, for example, the rise in homeworking simply be a temporary phenomenon reflecting employers' responses to challenges in filling vacancies?

Figure 8 shows how the total number of job adverts and the percentage those adverts offering WFH opportunities have changed within the eight job categories most likely to offer WFH opportunities in January 2022. The number of job adverts within each job category is shown on the vertical axis, while the proportion of these adverts that offer WFH opportunities is shown on the horizontal axis. Each point represents the number of adverts paired with the percentage of the adverts offering homeworking opportunities for a given month of our sample which runs from January 2018 to January 2022. The line connects successive months.

In general, we find that even when vacancies were falling relative to January 2020, the proportion of vacancies offering homeworking opportunities continued to rise in most sectors (although as per Table 2 and Figure 7 the rate of growth varied by job category). As vacancy

TABLE 2 Rankings of job categories by number of adverts offering work from home (WFH) opportunities.

January 2022					
Rank	Job category	WFH	Total	WFH (%)	Cumulative (%)
1	IT jobs	51,508	181,419	31.1	31.1
2	Accounting and finance jobs	18,736	89,894	11.3	42.5
3	Sales jobs	16,867	92,018	10.2	52.7
4	Public relations jobs	11,472	44,108	6.9	59.6
5	HR and recruitment jobs	8696	30,494	5.3	64.9
6	Engineering jobs	7853	98,945	4.7	69.6
7	Admin jobs	7163	52,729	4.3	74.0
8	Customer services jobs	5936	31,441	3.6	77.5
9	Trade and construction jobs	4685	87,536	2.8	80.4
10	Healthcare and nursing jobs	4149	81,263	2.5	82.9
11	Legal jobs	3919	20,378	2.4	85.3
12	Social work jobs	3722	63,400	2.3	87.5
13	Consultancy jobs	3609	18,874	2.2	89.7
Total across all 38 job categories		165,358	1,305,135		

Note: Figures in the WFH (%) column show adverts offering opportunities for homeworking in the stated job category as a percentage of the total number of adverts offering homeworking opportunities, regardless of category. Rank is the outcome of ordering job categories by the total number of vacancies in each job category that offer opportunities for homeworking.

numbers have since started to rise, in some categories—sales, engineering, administration and so on—the rate of growth has tailed off in recent months but, equally, not fallen back significantly. This illustrated by the relative steepness of the lines showing that as vacancies have risen (moving up the vertical axis) the proportion of jobs offering homeworking opportunities has remained relatively constant. To what extent different factors are at play in explaining such trends is yet to be determined and will be interesting for future research. For example, it could be that recent increases have been driven, not by the 'stay-at-home' guidance from early in the pandemic, but by employers responding to recruitment gaps through embracing more flexible working opportunities. Interestingly, Figure 8 does seem to suggest—at least speculatively at this stage—that sectors where vacancies were substantially higher in January 2022 compared to prepandemic levels have witnessed continued (albeit slower) growth in homeworking opportunities (e.g., HR and Recruitment, IT and Public Relations).

One job category that moved up the WFH rankings early in the pandemic is Customer Services. Such jobs accounted for fewer than 2% of all adverts offering opportunities to WFH in February 2020 but jumped to 13% of all vacancies offering WFH opportunities in June 2020. The total number of jobs adverts in this category was 104% higher in January 2022 than in February 2020. Only 345 of 19,519 Customer Services job adverts mentioned opportunities to WFH in February 2020, rising to 3471 of 9193 in June 2020 then reaching 5942 of 31,443 in January 2022. As Figure 8 shows however, we see some reversion in the proportion of job adverts offering homeworking opportunities in this sector and infer that a part of the earlier uplift was temporary and likely to have been driven by necessity during the pandemic.
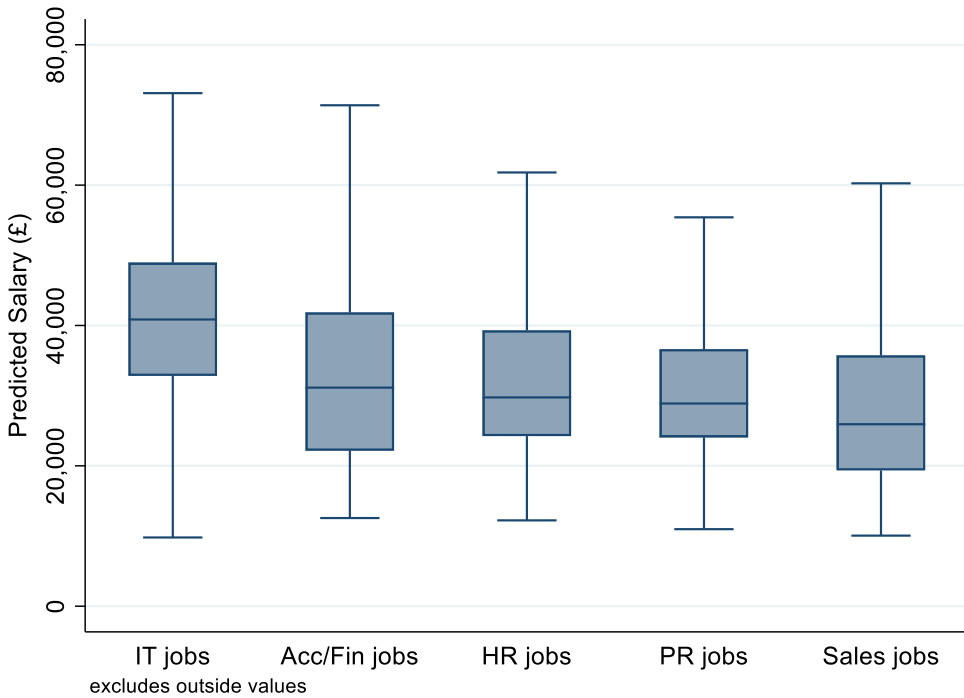
FIGURE 7   The distribution of predicted salaries for the five job categories that advertise the largest number of opportunities for WFH in January 2022. (A) To construct this figure, the raw data on predicted salary by job categories were analysed from all adverts offering WFH opportunities collated by Adzuna in the final week of January 2022. The five categories selected as those with the largest numbers of adverts offering WFH opportunities at this time. (B) The box plots for predicted salaries in the selected job categories are shown in order of median salary, they are: IT, Accounting & Finance, Human Resources and Recruitment, Public Relations, and Sales jobs. These job categories together account for 64.9% of all job adverts collated by Adzuna in the last week of January 2022 that offered opportunities for homeworking. (C) The median salary in each job category is shown by the horizontal line drawn through each box and the upper and lower boundaries of the box indicate the 75th and 25th percentiles and the whiskers are scaled to extend two-thirds of the box width. Values outside the whiskers are not shown or used in the scaling of the vertical axis.

4.5 | WFH opportunities by salary decile

In the previous section, Figure 7 revealed opportunities for WFH can fall into very different salary bands. Our final chart, Figure 9, investigates how opportunities for WFH are distributed among salary deciles (where the deciles are constructed using Adzuna's predicted salary variable and across all jobs advertised at a given point in time, regardless of whether they offer WFH opportunities or not).

A higher concentration of these opportunities falls within the top salary deciles. This concentration is evident in the mid-pandemic period, for example, in January 2021, when the top three deciles together account for 44% of the jobs with WFH opportunities but is stronger still in January 2022 when the top three deciles account for 49% of all the adverts offering WFH opportunities.
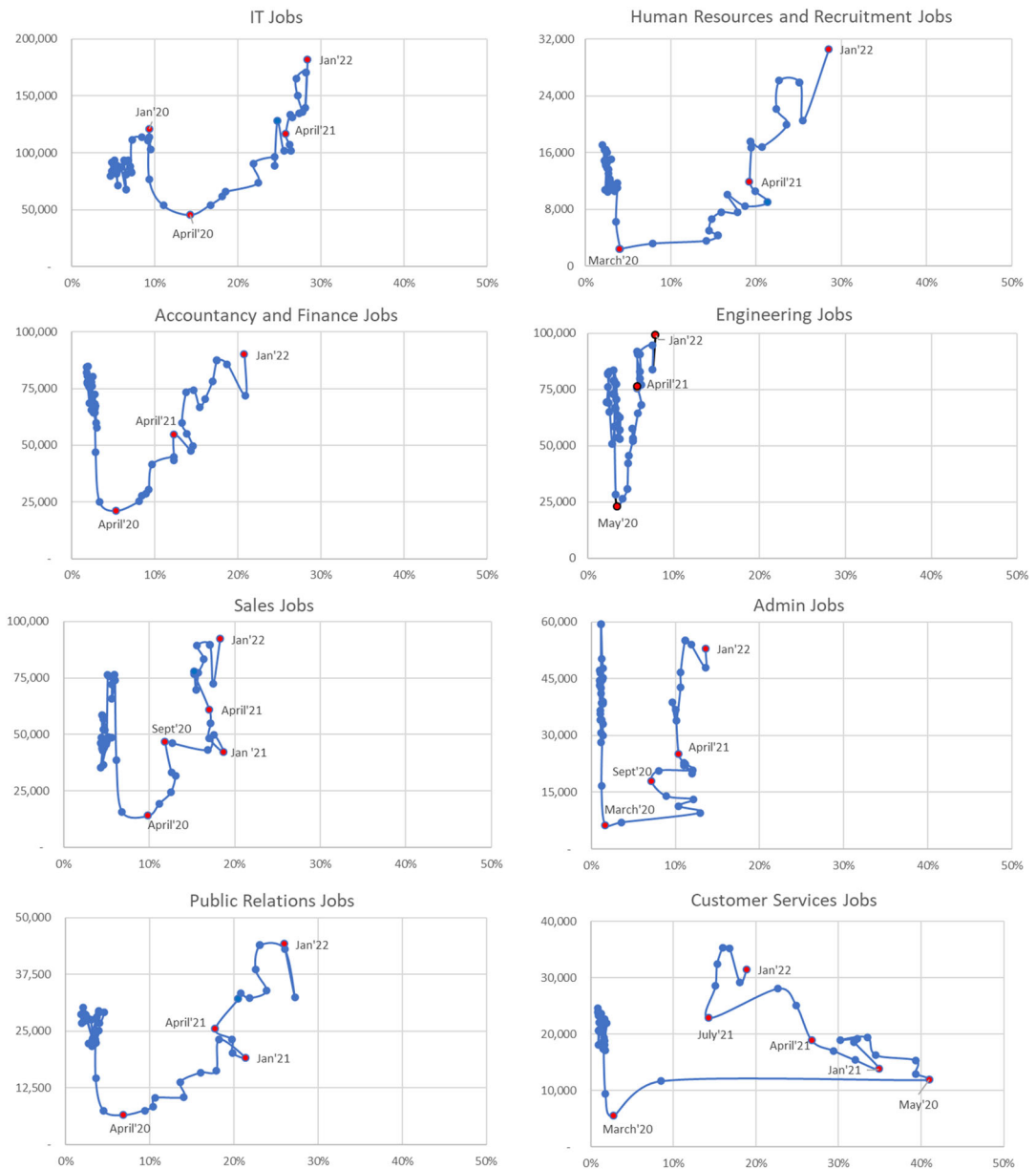
FIGURE 8 Number of job adverts plotted against % offering WFH opportunities selected job categories, January 2018 to January 2022. (A) The number of jobs adverts in the stated job category is indicated on the vertical axis in each panel and the percentage of those adverts that offer homeworking opportunities is indicated in the horizontal axis. (B) Each point represents the number of adverts and the corresponding percentage of adverts offering homeworking opportunities for a particular month in our sample, which runs from January 2018 to January 2022. The line joins consecutive months. (C) The vertical scales differ across each panel of this figure, but the horizontal scale is kept the same.
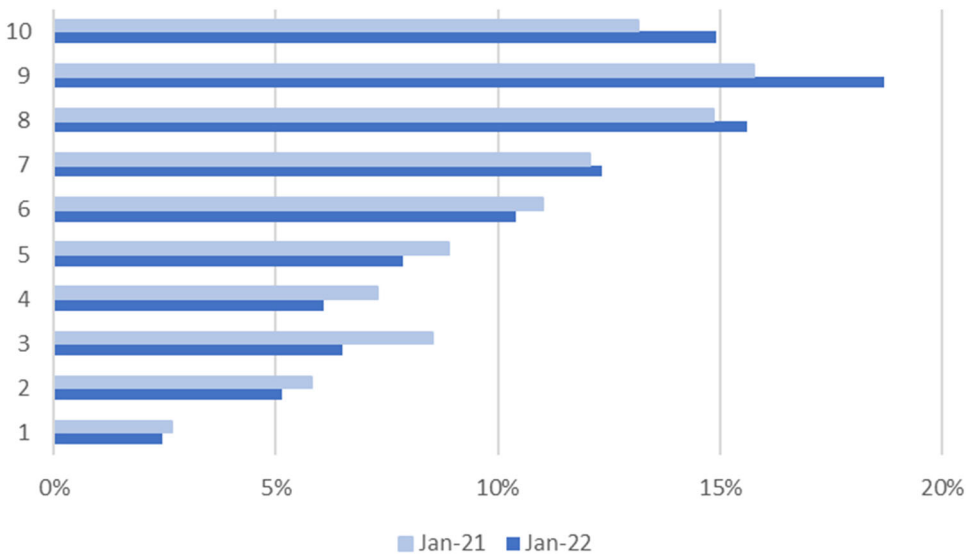
FIGURE 9 Advertised WFH opportunities by salary decile. All advertised jobs were sorted into salary deciles using Adzuna's predicted salary variable. The chart shows opportunities for WFH allocated to the appropriate decile.

5 | CONCLUSION

The Covid-19 pandemic induced a sudden change in the nature of work for many employees as businesses adapted to public health restrictions. Significant home and remote working became the norm for many. For some, this has been a welcome change, with benefits for productivity, work-life balance and wellbeing; for others, it has been less positive. As we move from the pandemic to the endemic phase of this public health crisis, businesses are reassessing the nature and type of work that they provide. For policymakers, understanding whether and to what extent the pandemic has led to a persistent reshaping of the nature of work is key to identifying new, and tackling existing, challenges in the labour market, including the gender pay gap, participation and inequality.

We demonstrated how business recruitment practices, as reflected in job adverts, have evolved particularly since early in 2020. Our findings support several emerging conclusions. During the first national lockdown, some asked whether the office enironment would 'cease to exist'. In the most recent data, we have shown that many employers have continued to advertise posts that explicitly mention opportunities for working from home. We have shown that these adverts increasingly refer to hybrid working, that is, a blend of homeworking/ working remotely and working at an office or business location, in a way designed to best facilitate productivity on different tasks, rather than requiring a single work location. Our evidence suggests that the office will not die, but it will not look the same and is likely to be used in different ways. We also documented (in Figure 8) how job adverts offering homeworking evolved alongside changes in job vacancies through the pandemic.

We conclude there is a general pattern across job categories of homeworking becoming more common through the pandemic as the number of job vacancies ebbed and flowed, and the extent to which these trends evolve to vacancy patterns over the long-term will be an important avenue for future research. Our findings also emphasise the importance of focusing not just on

changes in the aggregate number, or percentage, of homeworking but on the characteristics of jobs that look to be continuing to offer this opportunity as the pandemic recedes. Adverts for some openings, for example, for IT, Accounting & Finance, and Sales roles, show a persistent shift toward offering homeworking opportunities, in some cases no doubt bolstered by investment in technologies and having broken down actual and perceived barriers that limited flexibility in the location of work before the pandemic. However, lower-paid job openings, for example, in Customer Services, look to be rapidly reverting toward prepandemic norms. Our analysis of salary information has unambiguously shown that job adverts that explicitly mention opportunities for homeworking are becoming increasingly concentrated among higher-paid jobs.

Policymakers, employers and trade unions seeking to address critical challenges in the labour market need to be aware of the changes that have occurred through the pandemic. While increased homeworking has afforded significant benefits for some workers, our evidence suggests that a greater polarisation of these opportunities is underway. Although many high-paid workers look to be able to choose to reap this additional benefit, they are leaving behind lower-paid workers who are more likely to face opportunities that are seeing a reversion to prepandemic norms.

ORCID
Julia Darby http://orcid.org/0000-0003-4425-7222
Stuart McIntyre http://orcid.org/0000-0002-0640-7544
Graeme Roy https://orcid.org/0000-0002-5376-5408

REFERENCES
Adams-Prassl, A., Boneva, T., Golin, M., & Rauh, C. (2022). Work that can be done from home: Evidence on variation within and across occupations and industries. *Labour Economics*, *74*, 1–13. https://doi.org/10.1016/j.labeco.2021.102083

Bai, J., Brynjolfsson, E., Jin, W., Steffen, S., & Wan, C. (2021). *Digital resilience: How work-from-home feasibility affects firm performance.* NBER Working Paper, 28588. https://www.nber.org/papers/w28588.

Banks, J., & Xu, X. (2020). The mental health effects of the first two months of lockdown during the COVID-19 pandemic in the UK. *Fiscal Studies*, *43*(3), 685–708.

Barrero, J. M., Bloom, N., & Davis, S. J. (2021). *Why working from home will stick.* NBER Working Paper, 28731. 1–64. https://doi.org/10.3386/w28731

Barrot, J. N., Grassi, B., & Sauvagant, J. (2021). Sectoral effects of social distancing. *AEA Papers and Proceedings*, *111*, 277–281.

Bartik, A. W., Cullen, Z. B., Glaeser, E. D., Luca, M., & Stanton, C. T. (2020). *What jobs are being done at home during the Covid-19 crisis? evidence from firm-level surveys.* NBER Working Paper 27422, 1–26. https://doi.org/10.3386/w27422

Battiston, D., Vidal, J. B., & Kirchmaier, T. (2021). Face-to-face communication in organizations. *The Review of Economic Studies*, *88*(2), 574–609.

Beatson, M. (2019). *Megatrends: Flexible working.* Chartered Institute of Personnel and Development. https://www.cipd.co.uk/Images/megatrends-report-flexible-working-1_tcm18-52769.pdf

Bell, D., & Blanchflower, D. (2020). US and UK labour markets before and during the COVID-19 crash. *National Institute Economic Review*, *252*, R52–R69.

Bick, A., Blandin, A., & Mertens, K. (2020). *Work from home after the COVID-19 outbreak.* CEPR Discussion Paper, *2020,* 15000. https://cepr.org/active/publications/discussion_papers/dp.php?dpno=15000

Bloom, N., Liang, J., Roberts, J., & Yin, Z. J. (2015). Does working from home work? Evidence from a Chinese experiment. *The Quarterly Journal of Economics*, *130*(1), 165–218. https://doi.org/10.1093/qje/qju032

Bloom, N., Mizen, P., & Taneja, S. (2021). *Returning to the office will be hard*. VOXEU. https://voxeu.org/article/returning-office-will-be-hard

Brynjolfsson, E., Horton, J. J., Ozimek, A., Rock, D., Sharma, G., & Tu Ye, H.-Y. (2020). *COVID-19 and remote work: An early look at US data.* NBER Working Paper 27344, 1–25. https://doi.org/10.3386/w27344

Buchheim, L., Dovern, J., Krolage, C., & Link, S. (2022). Sentiment and firm behavior during the COVID-19 pandemic. *Journal of Economic Behavior & Organization*, *195*, 186–198. https://doi.org/10.1016/j.jebo.2022.01.011

Campello, M., Kankanhalli, G., & Muthukrishnan, P. (2020). *Corporate hiring under COVID-19: Labor market concentration, downskilling, and income inequality*. NBER Working Paper, 27208, 1–44. https://www.nber.org/papers/w27208

Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of Management*, *31*(6), 874–900.

Dingel, J. I., & Neiman, B. (2020). How many jobs can be done at home? *Journal of Public Economics*, *189*(89). https://doi.org/10.1016/j.jpubeco.2020.104235

Draca, M., Duchini, E., Rathelot, R., & Vattuone, G. (2021). *Remote work and the post-pandemic UK labour market, CAGE policy briefing 32/2021*. CAGE Research Centre, University of Warwick.

Dutcher, E. G. (2012). The effects of telecommuting on productivity: An experimental examination. The role of dull and creative tasks. *Journal of Economic Behavior & Organization*, *84*(1), 355–363.

Eberly, J. C., Haskel, J., & Mizen, P. (2021). *Potential capital, working from home, and economic resilience*. NBER Working Paper 29431, 1–38. https://doi.org/10.3386/w2943

Etheridge, B., Tang, L., & Wang, Y. (2020). Worker productivity during lockdown and working from home: Evidence from self-reports. *Covid Economics*, *52*, 118–151.

Felstead, A. (2022). *Remote working: A research overview*. Routledge.

Felstead, A., & Reuschke, D. (2020). *Homeworking in the UK: Before and during the 2020 lockdown*. WISERD Report, Cardiff: Wales Institute of Social and Economic Research. https://wiserd.ac.uk/publications/homeworking-ukand-during-2020-lockdown

Felstead, A., & Reuschke, D. (2021). A flash in the pan or a permanent change? The growth of homeworking during the pandemic and its effect on employee productivity in the UK. *Information Technology & People*. Advanced online publication. https://doi.org/10.1108/ITP-11-2020-0758

Haskel, J. (2020). What is the future of working from home? Economic Observatory. www.economicsobservatory.com/what-is-the-future-of-working-from-home

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science*, *10*(6), 791–815.

Lassébie, J., Marcolin, L., Vandeweyer, M., & Vignal, B. (2021). *Speaking the same language: A machine learning approach to classify skills in Burning Glass Technologies data*. OECD Social, Employment and Migration. Working Papers, No. 263, OECD Publishing, Paris. https://doi.org/10.1787/adb03746-en

Lees, C. (1999). The age of the homeworker? In J. Myerson (Ed.), *Work at home: The proceedings of the think tank on home-working at the Royal College of Art*. Royal College of Art.

Mateyka, P. J., Rapino, M., & Landivar, L. C. (2012). *Home-based workers in the United States: 2010*. U.S. Department of Commerce, Economics and Statistics Administration, US Census Bureau. https://www.census.gov/library/publications/2012/demo/p70-132.html

Mehdi, T., & Morissette, R. (2021). *Working from home: Productivity and preferences*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/45-28-0001/2021001/article/00012-eng.htm

Mongey, S., Pilossoph, L., & Weinberg, A. (2021). *Which workers bear the burden of social distancing?* NBER Working Paper, *19*, 27085–27526.

Morikawa, M. (2018). *Long commuting time and the benefits of telecommuting*. RIETI Discussion Paper. 18-E, 025.

Morikawa, M. (2020). Productivity of working from home during the COVID-19 pandemic: Evidence from an employee survey. *Covid Economics*, *49*, 123–147. https://cepr.org/file/9658

Oakman, J., Kinsman, N., Stuckey, R., Graham, M., & Weale, V. (2020). A rapid review of mental and physical health effects of working at home: How do we optimise health? *BMC Public Health*, *20*, 18–25. https://doi.org/10.1186/s12889-020-09875-z

O'Connor, S. (2020). *Goodbye to the 'Pret economy' and good luck to whatever replaces it*. Financial Times. https://www.ft.com/content/d8eb62ef-a1cb-4597-867b-15a79dbdcd5d

OECD. (2020). *Productivity gains from teleworking in the post COVID-19 era: How can public policies make it happen*. OECD Policy Responses to Coronavirus (COVID-19).

ONS. (2021a). *Coronavirus and attitudes to the future of homeworking*. Office for National Statistics, Newport. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/datasets/coronavirusandattitudestothefutureofhomeworking

ONS. (2021b). *Using Adzuna data to derive an indicator of weekly vacancies: Experimental Statistics*. Office for National Statistics, Newport. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/methodologies/usingadzunadatatoderiveanindicatorofweeklyvacanciesexperimentalstatistics

ONS. (2021c). *Business and individual attitudes towards the future of homeworking, UK: April to May 2021*. Office for National Statistics, Newport. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/businessandindividualattitudestowardsthefutureofhomeworkinguk/apriltomay2021

ONS. (2021d). *Online remote working job vacancies estimates*. Office for National Statistics, Newport. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/onlineremoteworkingjobvacanciesestimates

Palumbo, E. (2020). Let me go to the office! An investigation into the side effects of working from home on work-life balance. *International Journal of Public Sector Management*, *33*(6), 771–790.

Proto, E., & Zhang, A. (2021). COVID-19 and mental health of individuals with different personalities. *Proceedings of the National Academy of Sciences of the United States of America*, *118*(37), 1–7. https://doi.org/10.1073/pnas.2109282118

Pyper, D. (2015). *Flexible working*. House of Commons Library Briefing Paper, 01086. https://researchbriefings.files.parliament.uk/documents/SN01086/SN01086.pdf

Scase, R. (1999). *Britain towards 2010*. The Changing Business Environment. Department for Trade and Industry.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher*, *27*(2), 4–13.

Taneja, S., Mizen, P., & Bloom, N. (2021). *Working from home is revolutionising the UK labour market*. VoxEU. https://voxeu.org/article/working-home-revolutionising-uk-labour-market

Taylor, H., Florisson, R., & Hooper, D. (2021). *Making hybrid inclusive—Key priorities for policymakers*. Policy Brief, Chartered Management Institute and Work Foundation. https://www.managers.org.uk/wp-content/uploads/2021/10/wf-cmi-making-hybrid-inclusive-policy-brief.pdf

Turrell, A., Speigner, B., Copple, D., Djumalieva, J., & Thurgood, J. (2021). Is the UK's productivity puzzle mostly driven by occupational mismatch? An analysis using big data on job vacancies. *Labour Economics*, *71*(C), 1–12.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.