

The Impact of the National Living Wage on Businesses: Evidence from New Survey and Linked Datasets

Report to the Low Pay Commission

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Executive Summary

Background and approach

Over the period since the National Living Wage (NLW) came into force in the UK on 1st April 2016, increases in the minimum wage have outstripped growth in average wages – in some years by a substantial amount – and are expected to continue to do so in the near future.

There has been some evidence of non-compliance but, in most cases, employers appear to have accepted the implicit increase in labour costs and to have made adjustments. Potential adjustments may include substituting capital for labour, increasing labour productivity, taking lower profits or raising prices, among other things.

Existing research into firms' responses to UK minimum wage increases suggests that the most common responses have been to take lower profits or increase productivity. There is also some evidence that firms raised prices.

One limitation of this existing research is that it provides few details of how any productivity increases have been achieved. Another limitation is that many studies lack a clear measure of those firms which are (or are not) affected by the wage floor, with exposure typically measured via average wage levels in the firm as a whole or at sector level.

Our research seeks to provide new evidence on businesses' responses to minimum wages through a study of a sample of firms for whom exposure to the wage floor is known. The sample of firms is obtained from the Labour Market Outlook (LMO) surveys undertaken by the Chartered Institute for Personnel and Development (CIPD).

We present evidence on organisations' experiences of the NLW from the LMO surveys of Autumn 2015, Summer 2018 and Summer 2019. Each of these surveys provides rich information on firms' exposure to the NLW and on their responses to increases in the NLW wage rates. Evidence from the 2015 survey was previously reported by D'Arcy and Davies (2016). We present evidence from all three waves to provide an updated view of firms' experiences of the NLW. We also report on new questions that we have developed for the 2018 and 2019 surveys which ask in detail about any productivity-related responses that the organisation may have undertaken.

We also present analyses of a subset of the 2015 and 2018 survey samples, which we have linked for the first time to company accounts data in the FAME database. This linked dataset uses organisations' direct reports about their exposure to the NLW, provided in the LMO surveys, to examine the comparative performance of NLW-exposed and non-exposed firms over a number of years.

Findings from the LMO surveys

The 2015 LMO asked whether the introduction of the NLW at a rate of £7.20 in April 2016 would increase the organisation's wage bill *ex ante*, whilst the 2018 and 2019 LMOs asked whether the introduction and subsequent increases in the NLW had done so *ex post*. The pattern of exposure to the NLW was very consistent across the three surveys, with just over half of all organisations seeing some impact on their wage bill (55-57%, depending on the year). In around one in six organisations (16-19%), the wage bill had been affected "to a large extent", in around one fifth (21-23%) "to some extent" and in around one sixth (15-18%) it had been affected "to a small extent".

In 2015, employers were asked how they planned to respond to the NLW. “Improve efficiency/raise productivity” was the most common anticipated response, with 30 per cent of employers stating that they planned to do this, while 22 per cent planned to “take lower profits/absorb costs” and 15 per cent planned to “raise prices”. When, in 2018 and 2019, organisations were asked what they had done, the most common response was to take lower profits (31-34%), following by raising productivity (24-26%) and raising prices (21-23%). Around 15% of all NLW-affected organisations in 2018 and 2019 reported that they had reduced headcount and around 10% had reduced hours. However, headcount and hours reductions were more common among organisations in which the NLW had raised the wage bill to ‘a large extent’: 20-22% of these organisations had reduced headcount and 15-19% had reduced hours, depending on the year.

The surveys also revealed sectoral differences, with employers in Wholesale/retail focusing more on headcount, overtime and bonuses, whilst employers in Hotels/catering/leisure more likely to raise prices. These findings are consistent with the analysis of employment retention in Aitken et al (2019), who find that any negative effects on employment retention of the introduction of the NLW have been concentrated in the Wholesale/retail sector.

Further, more detailed questions about firms’ responses, included in the 2018 and 2019 LMO surveys, revealed a wider array of responses that could reasonably be considered under the heading of “raising productivity”. All firms reporting exposure to the NLW were given an explicit list of possible productivity-related actions and asked whether they had undertaken any of these actions “in direct response to the increase in [their] wage bill caused by the introduction of the National Living Wage”. Some 75% of firms affected by the NLW chose at least one action from the list in 2018, with 68% doing so in 2019, indicating that productivity responses are more widespread than previously thought.

The data on productivity responses suggest that many organisations’ response to the National Living Wage has been to intensify work or reorganise hours, with around one quarter of organisations having required staff to take on additional tasks, and a similar proportion having required staff to be more flexible in their hours of work; around one in seven had increased the pace of work or work standards. There was some evidence of organisations improving their business practices (e.g. quality control) or seeking to improve staff morale and motivation, and a small group (around one in ten) had automated tasks previously done by workers.

Around three-tenths of NLW-exposed organisations had maintained pay differentials between NLW-affected staff and their supervisors/managers since the introduction of the NLW, indicating some spillover effects from the NLW on the pay of workers higher up the wage distribution.

Findings from the linked LMO-FAME sample

Around one fifth (21%) of the 2015 LMO sample and three-tenths (28%) of the 2018 LMO sample could be matched to company accounts data from the FAME database using information on the company registration number or company name and postcode. This matching process yielded a total linked sample of 787 firms. The sample of firms for which we can observe key business outcomes such as labour costs and employment is around a quarter of this.

This linked sample was used to compare outcomes for firms that were differentially impacted by the introduction of the NLW. We distinguished between firms that reported that their wage bill was affected ‘to some extent’ or ‘to a large extent’ by the introduction of the NLW (the treated) and those who reported that their wage bill was affected ‘to a small’ extent or ‘not at all’ (the controls). We used a simple difference-in-differences set-up to evaluate the effect of the NLW on firm outcomes using

this linked sample. The pre-period was 2013-2015 and the post period was 2016-2018. We estimated the model including firm fixed effects and used robust regression to control for outliers in the data.

It was reassuring to note that the profile of NLW exposure was similar in the linked sample to that seen in the full LMO sample. However, firms in the linked sample were larger, on average, than firms in the full LMO sample, reflecting differential Companies House reporting requirements for firms in different size bands. The industry profile of the matched sample also differed in noticeable ways from that of the full LMO sample. These differences were accommodated in our statistical analysis by including demographic variables as covariates in some specifications.

We found that firms that reported being more affected by the NLW saw an increase in their average labour costs of around 2 per cent. We found no effects on firms' employment levels or profit margins. We found some evidence that firms may have increased capital investment in response to the NLW, which could have increased their labour productivity. The results of this analysis should be treated with some caution due to small sample sizes.

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1 Introduction

1.1 Background to the research

In his July 2015 budget, the Chancellor announced the introduction of a National Living Wage (NLW), set at an initial level of £7.20 for workers aged 25+. This NLW, which came into force on 1st April 2016, amounted to a 50p (7%) rise in the adult minimum wage from the rate of £6.70/hr set in October 2015, and a 70p (11%) rise on the rate of £6.50 which applied in April 2015.

At the same time, the Chancellor also announced a commitment to raise the level of the NLW from 52.5% of median hourly earnings (in 2015) to 60% of median earnings by 2020: projected then to be around £9.35. Subsequent up-ratings have followed a path towards this 60% target, although weak growth in average earnings has revised the monetary figure of the target downwards to £8.72.¹ Over this period, increases in the minimum wage have thus outstripped average wage growth – in some years by a substantial amount – and are likely to continue to do so in the near future.

Businesses may respond in a number of ways to increases in minimum wages. There has been some evidence of non-compliance and under-payment (Low Pay Commission, 2018: 72-73), but in most cases, employers have accepted the implicit increase in labour costs and have sought to make adjustments on other dimensions. The majority of evidence for the UK suggests that there has been little impact on businesses' employment levels. Instead, the Labour Market Outlook (LMO) surveys undertaken among employers by the Chartered Institute of Personnel and Development (CIPD) surveys indicate that the three most popular actions among businesses have been to seek productivity improvements, absorb the cost by taking lower profits and to raise prices.

Increases in productivity, in particular, are widely considered to be the most sustainable route to accommodate minimum wage rises. For example, businesses may substitute capital for labour because the relative cost of labour increases with the NMW. Employers may provide more training for their employees or may improve management and work practices. Alternatively, productivity increases may simply come about through increased worker effort in response to receiving a better wage. Riley and Rosazza Bondibene (2017) provide an overview of the potential links between minimum wages and firms' productivity.

A number of studies have found evidence to suggest that firms may have increased their productivity in response to labour cost increases associated with the minimum wage (Galindo-Rueda & Pereira, 2004; Rizov & Croucher, 2011; Riley and Rosazza Bondibene, 2015 and 2017). The mechanisms through which these productivity improvements have come about has been more difficult to identify, however, with few studies finding evidence of capital-labour substitution, changes in capital investment, increases in training or increased worker effort (see Riley and Rosazza Bondibene, 2015, 2017; Bernini and Riley, 2016). There is also evidence that profitability has been reduced amongst low-paying firms, although the extent to which studies find this to be the case varies (see Draca, Machin and Van Reenen, 2005, 2011; Forth et al, 2009).

One limitation of much of this evidence is that many of the existing research studies lack a clear measure of those firms which are (or are not) affected by the wage floor. Exposure is typically measured via average wage levels in the firm as a whole. Whilst undoubtedly positively correlated with exposure to the minimum wage, this provides a blunt indicator of the true extent of exposure.

¹ See Low Pay Commission (2017: 4-5, 64; 2019: xiii)

The studies of care homes undertaken by researchers at the London School of Economics (e.g. Guipponi et al, 2016), are a notable exception to this general rule, having access to survey data on the numbers of workers in each care home that are paid at or around the minimum wage. This permits a more precise measure of the ‘bite’ of the minimum wage on individual firms. However, these data only cover one low-wage sector.

1.2 Our approach

Our research seeks to provide new evidence on the relationship between minimum wages and firms' labour costs, productivity, capital investment and profitability through a study of a sample of firms for whom exposure to the NLW is known.

Our approach is centred on the CIPD's Labour Market Outlook (LMO) Surveys. These surveys, which take place each quarter with an online sample of senior managers and HR professionals, have periodically included questions that identify firms' exposure to the National Living Wage. There are few other data sources that allow us to identify NLW-exposed firms – and thus their possible productivity responses - with such precision.

The research had three elements:

- The first involved development and analysis of data from the LMO Surveys of Autumn 2015, Summer 2018 and Summer 2019. Each of these surveys provides rich information on firms' exposure to the NLW and their responses to increases in the NLW wage rates. Evidence from the 2015 survey was previously reported by D'Arcy and Davies (2016). We present evidence from this and the more recent waves, developed to provide an updated view of firms' experiences of the NLW. We also report on new questions that we have developed for the 2018 and 2019 surveys which ask in detail about any productivity-related responses that the organisation may have undertaken.
- The second element involved linking data from the 2015 and 2018 LMO surveys to the FAME database of company accounts. In this strand of the project, we use organisations' direct reports about their exposure to the NLW to examine the comparative performance of NLW-exposed and non-exposed firms over a number of years. This element of the study builds on the analysis in Riley and Rosazza Bondibene (2015, 2017) and Bernini and Riley (2016). The CIPD LMO sample provides the indicator of NLW exposure, whilst the FAME dataset provides the measures of firm performance.
- The third element involved qualitative research among a small sample of NLW-exposed organisations – identified from the LMO survey samples – to explore their recent experiences in detail. The qualitative research assesses the extent to which the introduction of the National Living Wage – and its subsequent upratings – have raised the wage bill for companies, and explores how employers have delivered on productivity improvements.

In this report, we focus on the findings from the first two elements described above. Findings from the third, qualitative element of the project, will be the focus of further reporting in Spring 2020.

Taken together these various strands of research aim to provide the LPC with a better understanding of the links between the NLW and firms' productivity and business performance.

1.3 Structure and content of the report

Chapter 2 of the report presents new analysis of the 2015, 2018 and 2019 LMO surveys. The chapter first explores the extent of organisations' exposure to the NLW. It then goes on to explore the actions

that organisations have taken in response to the increase in their wage bills, with a particular focus on productivity-related responses. Finally, it explores the impact of the NLW on pay differentials.

Chapter 3 presents analysis of the 2015 and 2018 LMO surveys linked to the FAME database of company accounts. This chapter provides an account of the linking process and presents an analysis of the nature of the linked sample, before going on to present some analysis of company performance among exposed and non-exposed firms.

2 Analysis of the LMO Surveys

2.1 The LMO surveys

The CIPD's Labour Market Outlook is a quarterly survey of senior managers and HR professionals, undertaken by YouGov using its established online panel. Since 2015, it has periodically included a small number of questions asking respondents about their organisation's exposure to the National Living Wage (*ex ante* in Autumn 2015 and *ex post* in Summer 2018/Autumn 2019). These questions are followed by others asking about adjustments that the firm has made in response to any increase in its wage bill arising from the NLW.

The following sections present – for the first time – a combined analysis of responses to the LMO over the three time points and to new questions regarding firms' responses to the NLW. This enables us to provide an indication of how firms' experiences of the NLW have been changing. The chapter also presents analysis of new questions that we developed for the 2018 and 2019 surveys to further investigate firms' productivity-related responses to the NLW.

The figures discussed below are based on data from 1,037 respondents in 2015, 2,001 respondents in 2018 and 2,104 respondents in 2019. All responses have been weighted to be representative of the population of organisations with two or more employees in the UK.

2.2 Exposure to the NLW

The question asked in the LMO survey that focuses on measuring the organisation's exposure to the NLW has naturally varied slightly over time. The specific question text from each survey is as follows:

Autumn 2015 LMO:

“In July 2015, the Chancellor of the Exchequer announced the introduction of a new compulsory National Living Wage (NLW). The NLW will be paid to workers aged 25 and above. Initially, it will be set at £7.20 an hour, with a target of it reaching more than £9 an hour by 2020. There are no proposals to raise the current minimum wage rates for under 25s or the current apprenticeship rates. Do you expect that this higher minimum wage for those aged 25+ will increase your organisation's wage bill?”

Summer 2018 LMO:

“In April 2016, the National Minimum Wage of £6.70 per hour was replaced with a new National Living Wage of £7.20 per hour for all workers aged 25 and above. The minimum wage rate for workers aged 25 and above has since increased to £7.83 per hour from April 2018, an overall increase of £1.13 per hour over the last two and a half years, since early 2016. Have these increases in the minimum wage rate for workers aged 25 and above increased your wage bill over the last two and half years, since early 2016?”

Autumn 2019 LMO:

“In April 2016, the National Minimum Wage of £6.70 per hour was replaced with a new National Living Wage (NLW) of £7.20 per hour for all workers aged 25 and above. The National Living Wage rate for workers aged 25 and above has since increased to £8.21 per hour from April 2019, an overall increase of £1.51 per hour since 2016.

Additionally, National Minimum Wage rates were introduced for younger age groups and apprentices. These current rates for these groups, which have also seen similarly sharp increases are:

£7.70 an hour for 21-24 year olds

£6.15 for 18-20 year olds

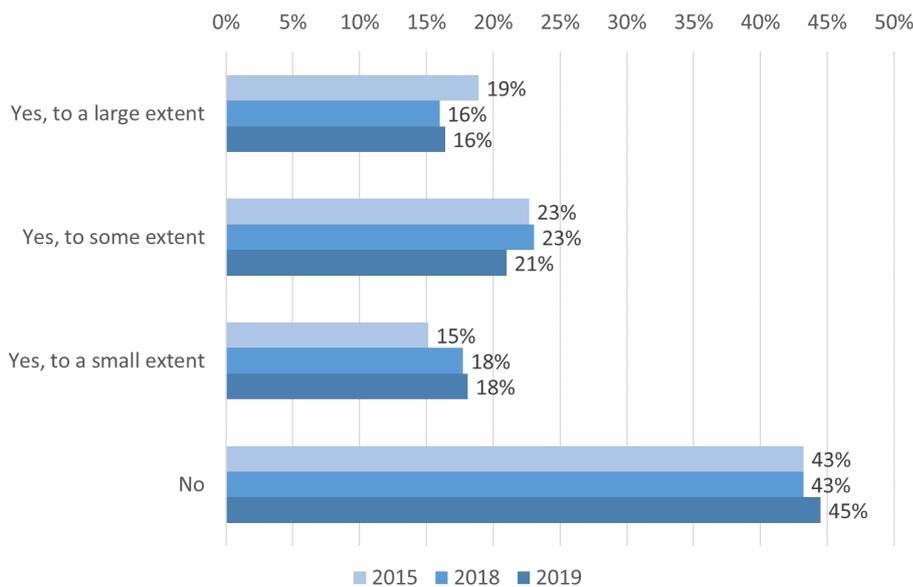
£4.35 for people aged under 18

£3.90 for apprentices.

Have the introduction of and subsequent increases in the National Living Wage and National Minimum Wage increased your wage bill since the run-up to the introduction of the NLW in April 2016?"

Figure 1 below shows that the pattern of exposure to the NLW is very consistent across the three time points. In each year, just over half of all organisations had seen some impact on their wage bill from the NLW, with around one in six finding that it had affected their wage bill “to a large extent”.

Figure 1: Exposure to the NLW by year



Base: all organisations with two or more employees in the UK

Note: excludes ‘don’t know’ responses which account for 5% of weighted responses in 2015 and 11 per cent of weighted responses in 2018 and 2019.

In the Figures which follow, the analysis focuses on two binary indicators derived from this four-category variable:

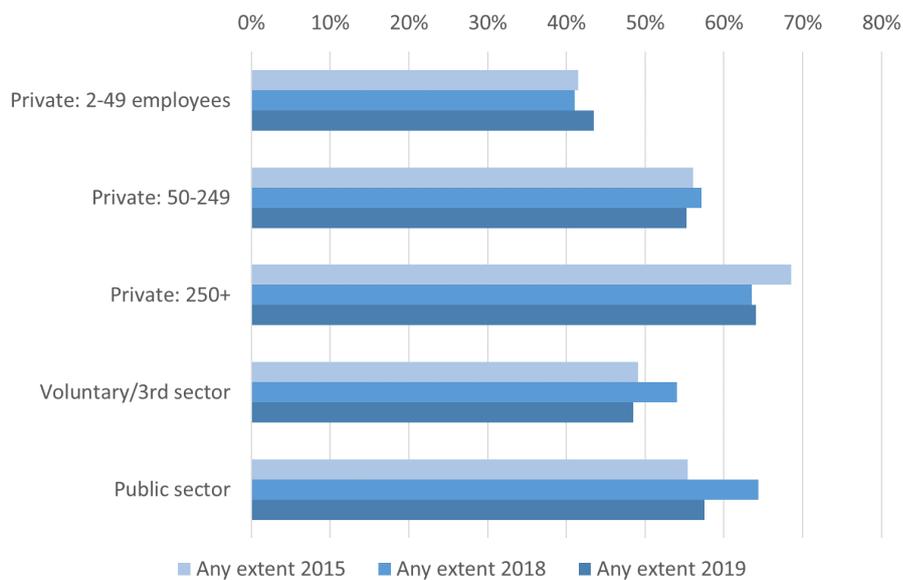
- *Any exposure:* respondent reports that the firm’s wage bill has been affected at least ‘to a small extent’
- *High exposure:* respondent reports that the firm’s wage bill has been affected ‘to a large extent’

Figure 2, Figure 3 and Figure 4 tabulate these two indicators by size/ownership sector, industry and region.

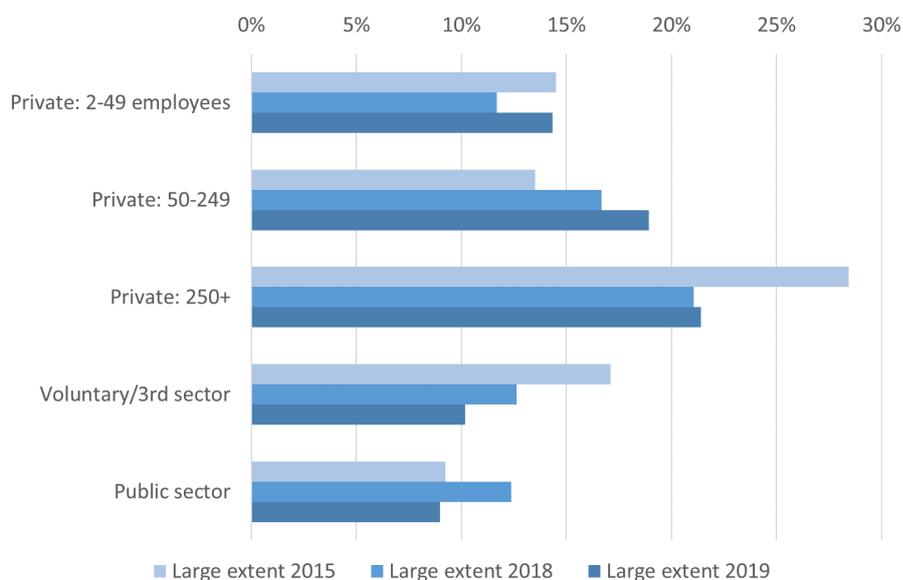
Figure 2 shows that exposure to the NLW has been most prevalent among large private sector organisations, with around two-thirds seeing some effect on their wage bill and around one fifth seeing their wage bill affected to ‘a large extent’. The majority of public sector organisations have seen some effect but, here, the percentage seeing a large effect has been relatively small, with the implication being that such organisations tend to have relatively few employees on NLW rates.

Figure 2: Exposure by size/sector, by year

Panel A: Affected to any extent



Panel B: Affected to a large extent



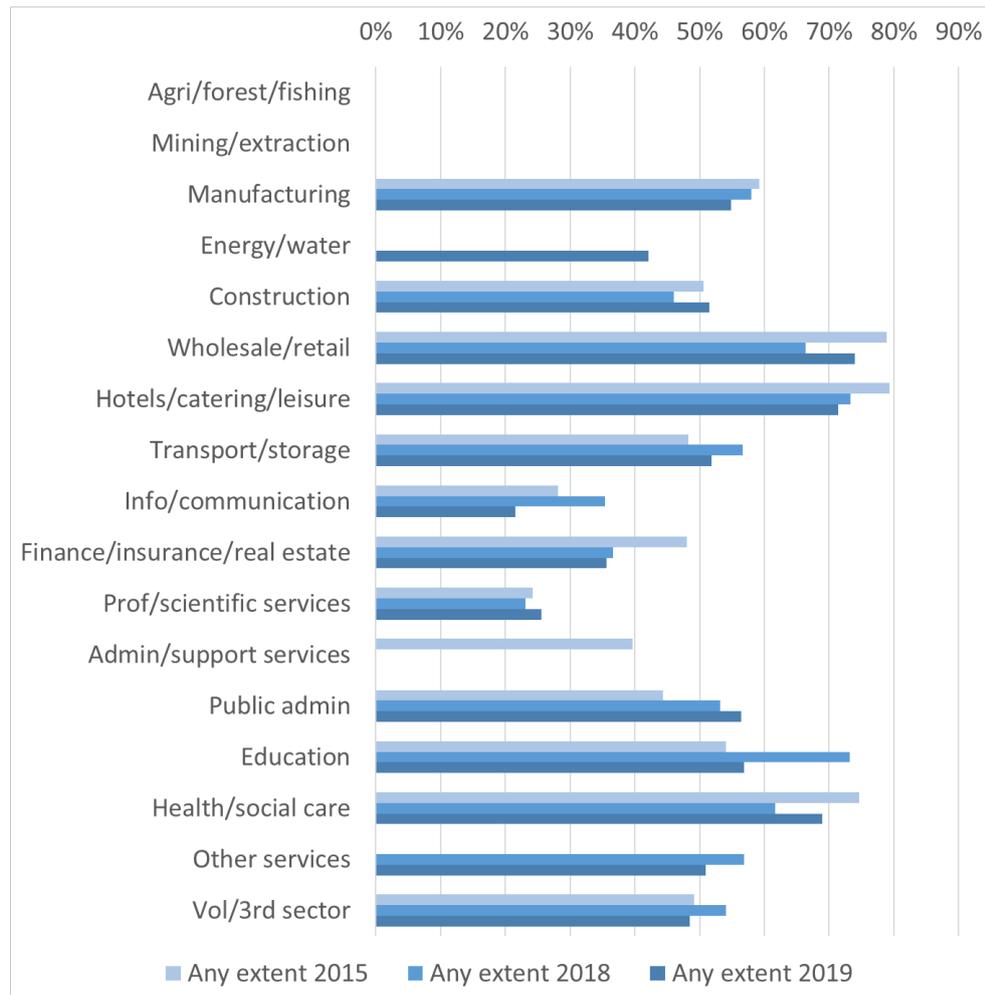
Base: all organisations with two or more employees in the UK

Note: this categorisation is derived from separate indicators for firm size (7 categories) and firm ownership (private/public/voluntary or third sector)

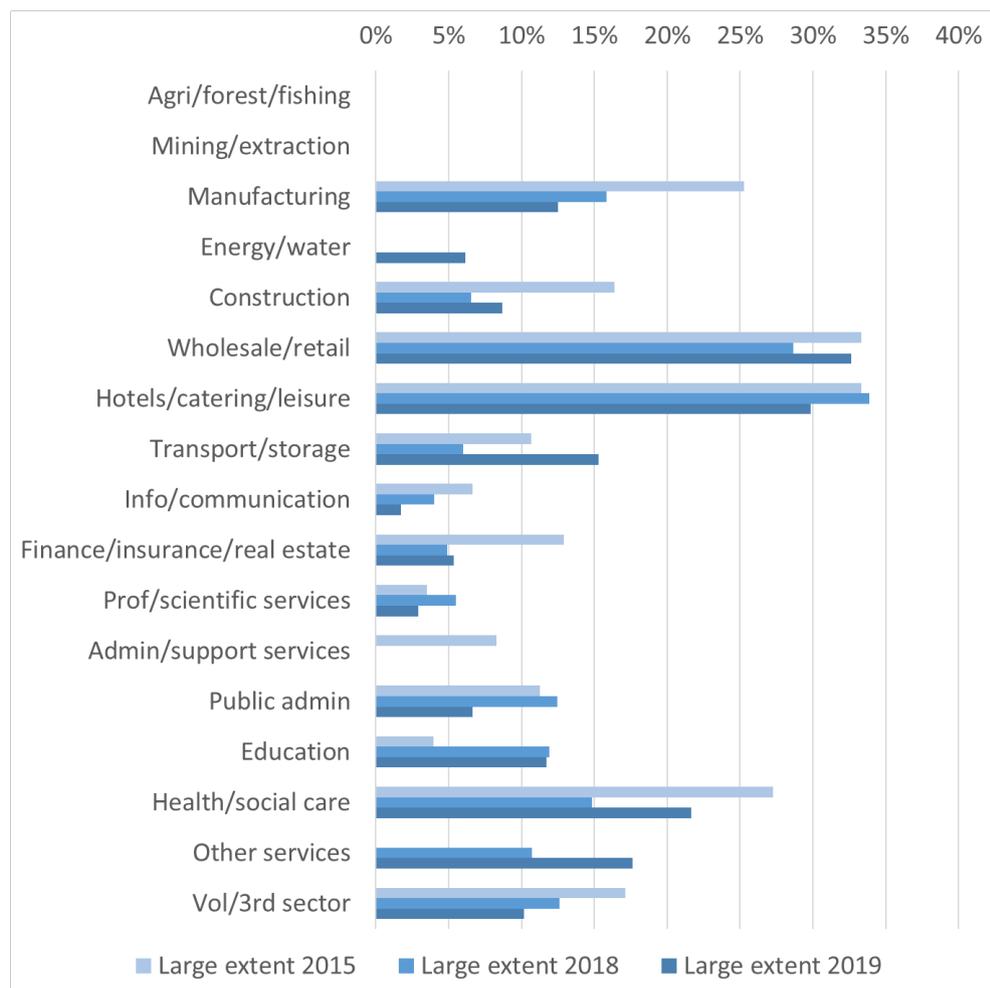
The LMO has a somewhat-idiosyncratic industry distribution. However, it is reassuring to note, in Figure 3, that those industries which report a large impact (Manufacturing, Wholesale/retail, Hotels/catering/leisure, and Health and social care) contain sub-sectors which official surveys would indicate have seen a relatively high impact of the NLW (i.e. food processing/textile manufacture, retail, hospitality and social care) (see Low Pay Commission, 2018: 232-3).

Figure 3: Exposure by industry, by year

Panel A: Affected to any extent



Panel B: Affected to a large extent



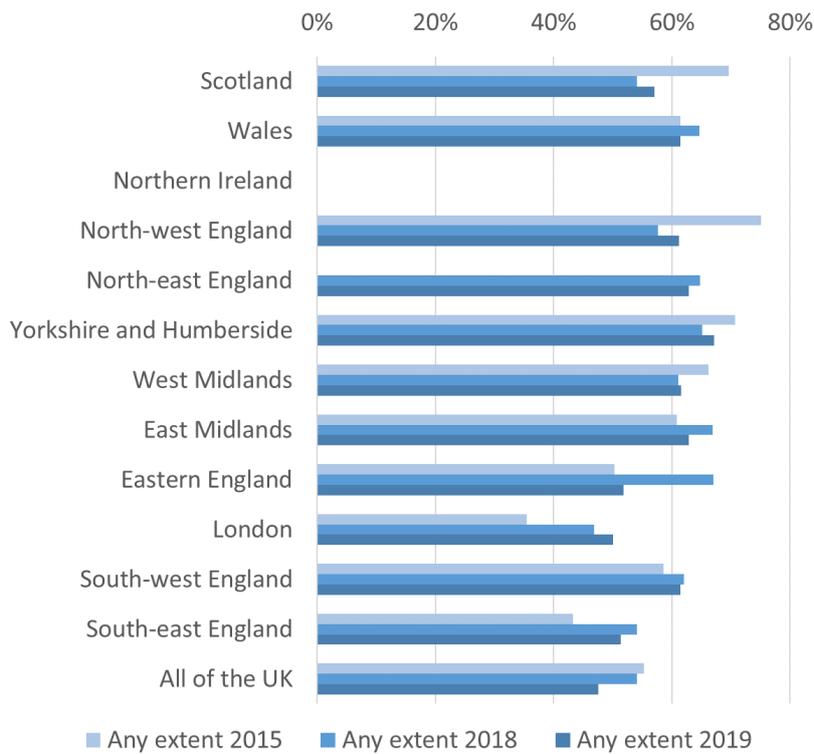
Base: all organisations with two or more employees in the UK

Notes: Industry categorisation does not necessarily align with the Standard Industrial Classification.

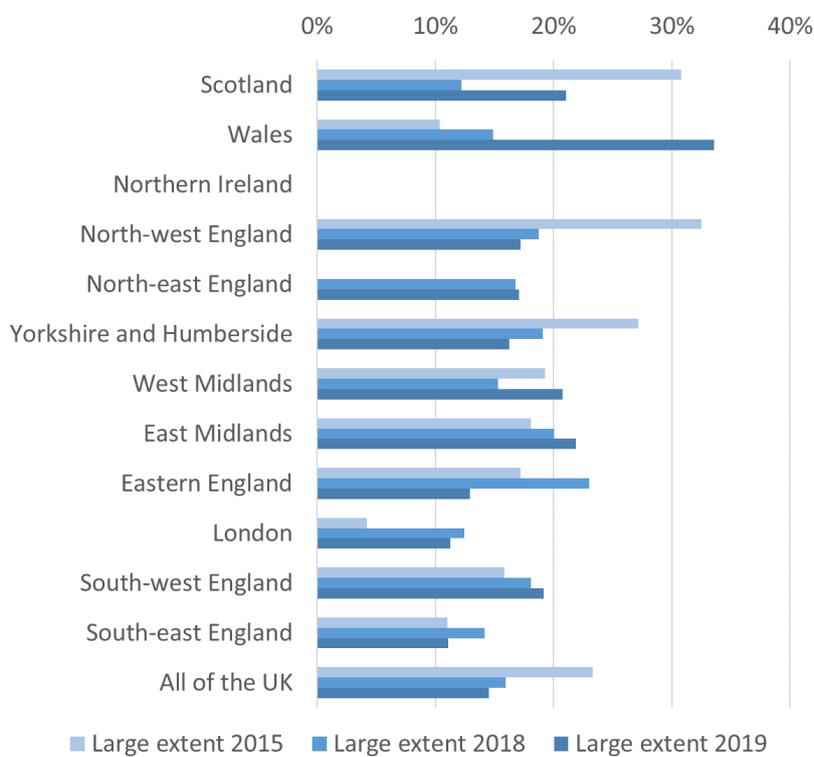
'Other services' coded only in 2018. Empty cells are industries with fewer than 25 observations.

Figure 4: Exposure by region, by year

Panel A: Affected to any extent



Panel B: Affected to a large extent



Base: all organisations with two or more employees in the UK

Note: Empty cells are regions with fewer than 25 observations.

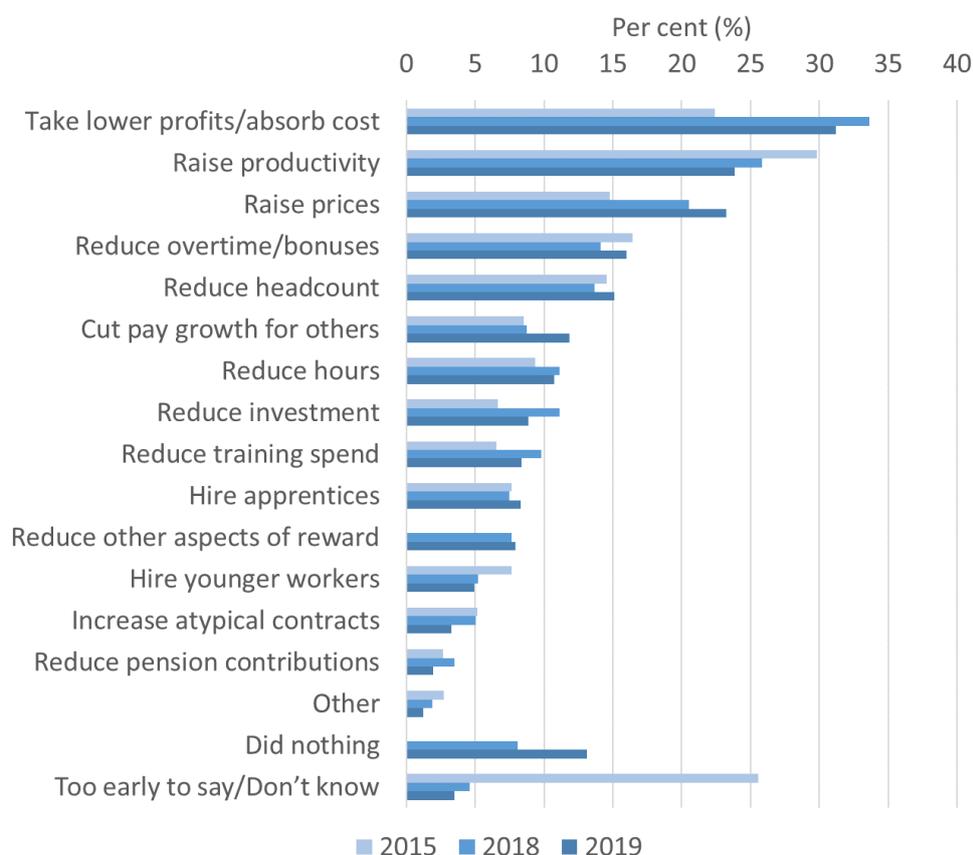
2.3 Responses to the NLW:

In 2015, those firms who anticipated an impact on their wage bill were asked what they planned to do in response (*ex ante*). In 2018/2019, those firms who reported an impact were asked what they had done (*ex post*). Respondents could choose up to three answers from a prescribed list, but also had the opportunity to mention actions not on the list.

Figure 5 shows that there has been a fair degree of consistency between 2018 and 2019, with ‘taking lower profits’, ‘raising productivity’ and ‘raising prices’ being the most commonly-cited responses in either year. However, perhaps reflecting the challenges that organisations have faced in raising productivity, it is noticeable the share of employers that cite productivity has fallen across the three surveys (to 24% in 2019), while the proportion that cite absorbing the cost or raising prices has risen during the same period.

According to the 2019 survey data, more than three in ten (31%) of those organisations that have been affected by the new higher wage floor have responded by absorbing the costs or taking lower profits – the most popular response. More than two-fifths (42%) of smaller organisations (those with 2-49 employees) said they had simply absorbed the cost, compared with just over a quarter (26%) of larger organisations. Other popular responses included raising prices (23%), reducing overtime or bonuses (16%) and reducing headcount either through redundancies or lower recruitment activity (15%).

Figure 5: Responses to the NLW by year

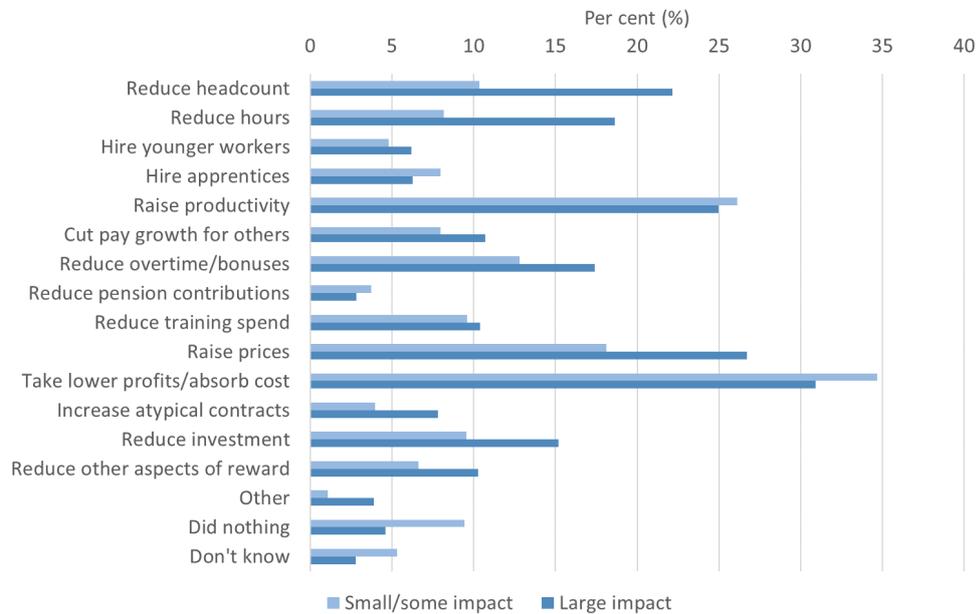


Base: all organisations with some exposure to the NLW

Note: two new response codes were added in 2018 (“Reduce other aspects of reward” and “Did nothing”)

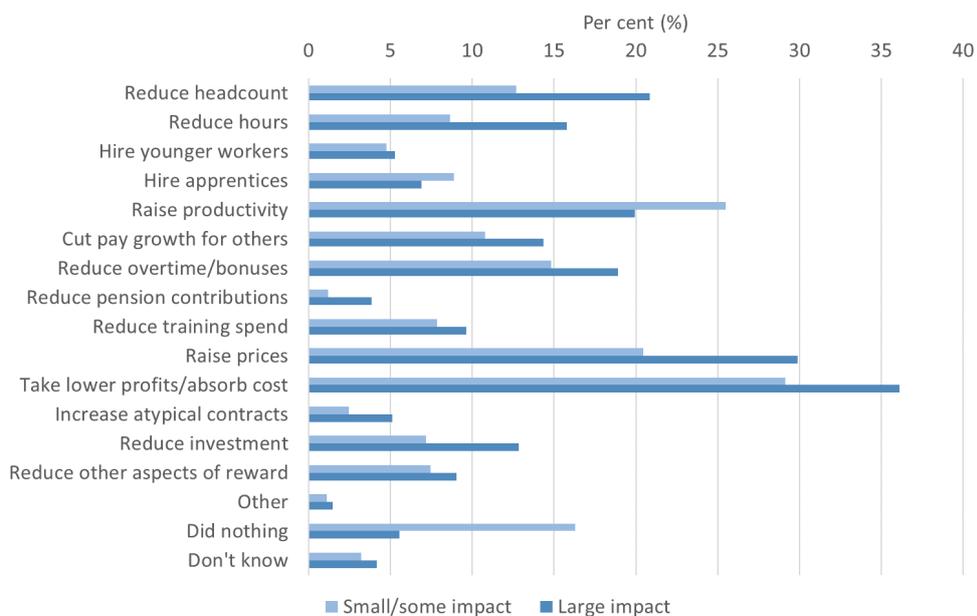
Figure 6 and Figure 7 show how responses vary by the degree of exposure to the NLW in 2018 and 2019. It is notable that ‘reducing headcount’ and ‘reducing hours’ are more commonly mentioned if the impact of the NLW has been large than if it is relatively small. Similarly, ‘raising prices’ is more common amongst those firms that have been most affected by the NLW.

Figure 6: Responses to the NLW, by degree of exposure, 2018



Base: all organisations with some exposure to the NLW

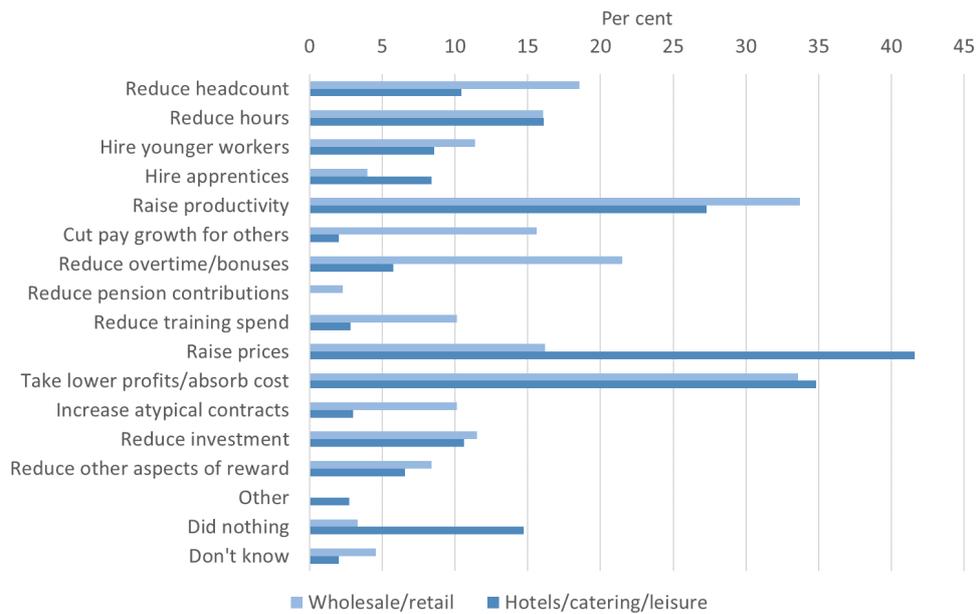
Figure 7: Responses to the NLW, by degree of exposure, 2019



Base: all organisations with some exposure to the NLW

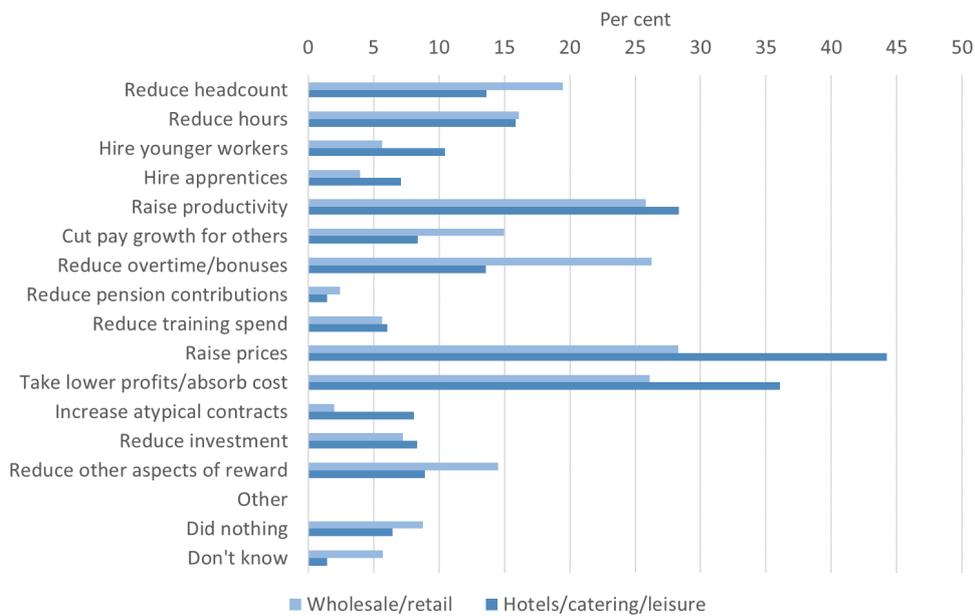
We can add further detail by looking at the patterns of responses shown in Figure 5 within two heavily-exposed sectors: Wholesale/retail and Hotels/catering/leisure. These are the two most exposed sectors in Figure 3. When we examine responses at the industry level in this way (Figure 8 and Figure 9), we see that employers in the two sectors appear to have responded to NLW exposure through different routes. Specifically, employers in Wholesale/retail appear to have focused more on headcount or overtime and bonuses, whereas employers in Hotels/catering/leisure seem to have focused more on price rises. These findings are consistent with the analysis of employment retention in Aitken, Dolton and Riley (2019), who find that any negative effects on employment retention of the introduction of the NLW have been concentrated in the Wholesale/retail sector.

Figure 8: Responses to the NLW in Wholesale/retail and Hotels/catering/leisure, 2018



Base: all organisations in Wholesale/retail and Hotels/catering/leisure with some exposure to the NLW

Figure 9: Responses to the NLW in Wholesale/retail and Hotels/catering/leisure, 2019



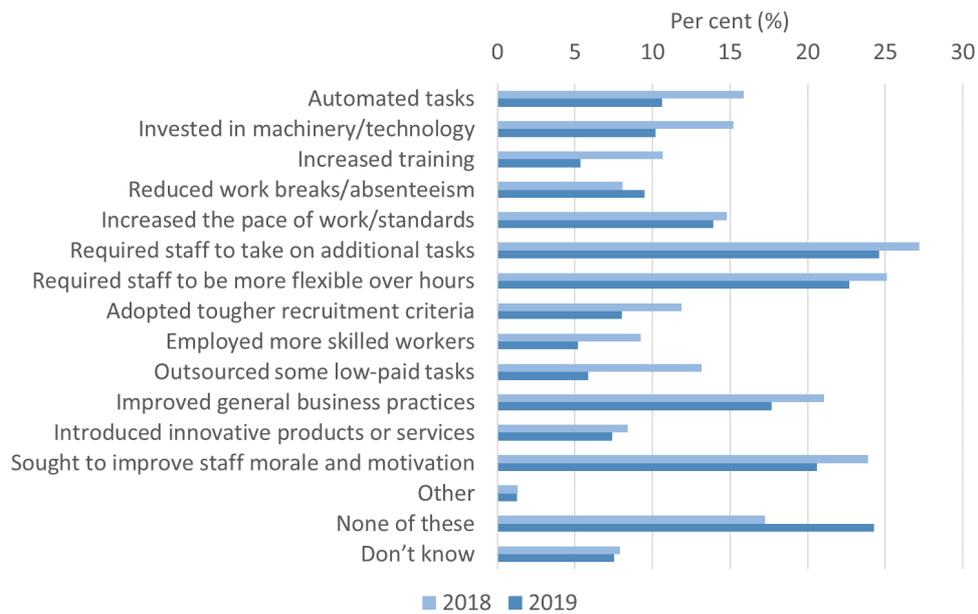
Base: all organisations in Wholesale/retail and Hotels/catering/leisure with some exposure to the NLW

2.4 Incidence of productivity-related responses

In an attempt to overcome the variation across employers in their understanding and interpretation of productivity, the 2018 and 2019 LMO surveys included an additional question about ‘other ways’ the organisation had responded to the National Living Wage. In these surveys, all firms reporting exposure to the NLW were given an explicit list of possible productivity-related actions and asked whether they had undertaken any of these. They were invited to choose any that their organisation had undertaken “in direct response to the increase in [their] wage bill caused by the introduction of the National Living Wage”. Some 75% of firms affected by the NLW chose at least one action from the list in 2018 (68% in 2019), indicating that productivity responses have been more widespread than previously thought.²

² It may, nevertheless, be the case that the NLW was not the only factor prompting such actions; indeed, our qualitative research indicated that the NLW was often one of a number of factors under consideration. However, we do not have information from the survey on the relative importance of the NLW in driving any decision; suffice it to say that respondents were only invited to consider actions that had been prompted in some part by the NLW.

Figure 10: Productivity-related responses to the NLW, by year

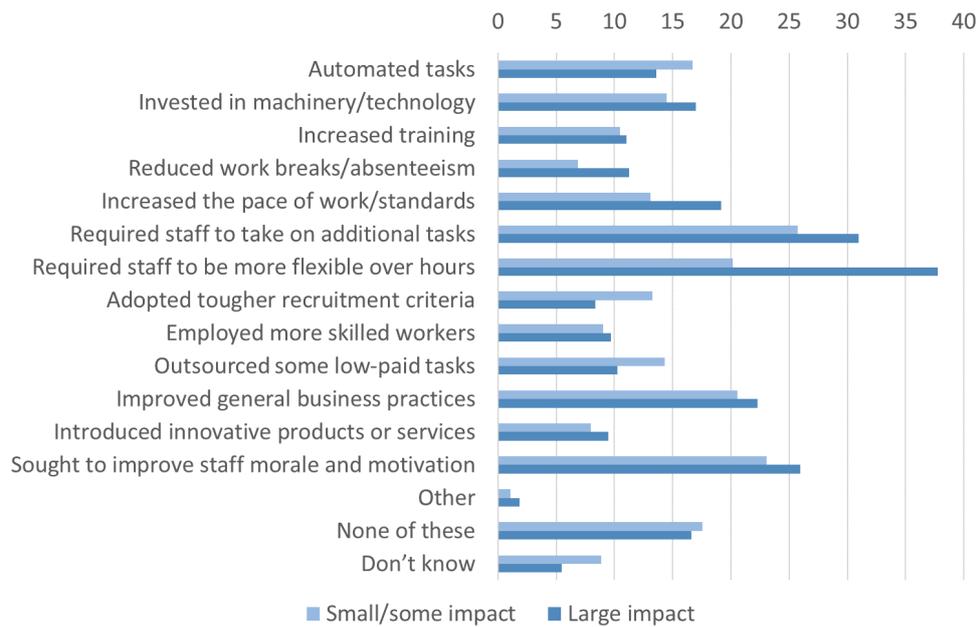


Base: all organisations with some exposure to the NLW

The survey data suggests that many organisations’ response to the National Living Wage has been to intensify work or reorganise hours. Around one quarter of organisations (25% in 2019) had required staff to take on additional tasks, while a similar proportion (23%) had required staff to be more flexible in their hours of work (Figure 10). Around one in six (14% in 2019) had increased the pace of work or raised work standards, whilst one in ten (9%) had reduced work breaks. Workplaces where the impact of the NLW had been larger were more likely than other workplaces to report these types of response (Figure 11 and Figure 12).

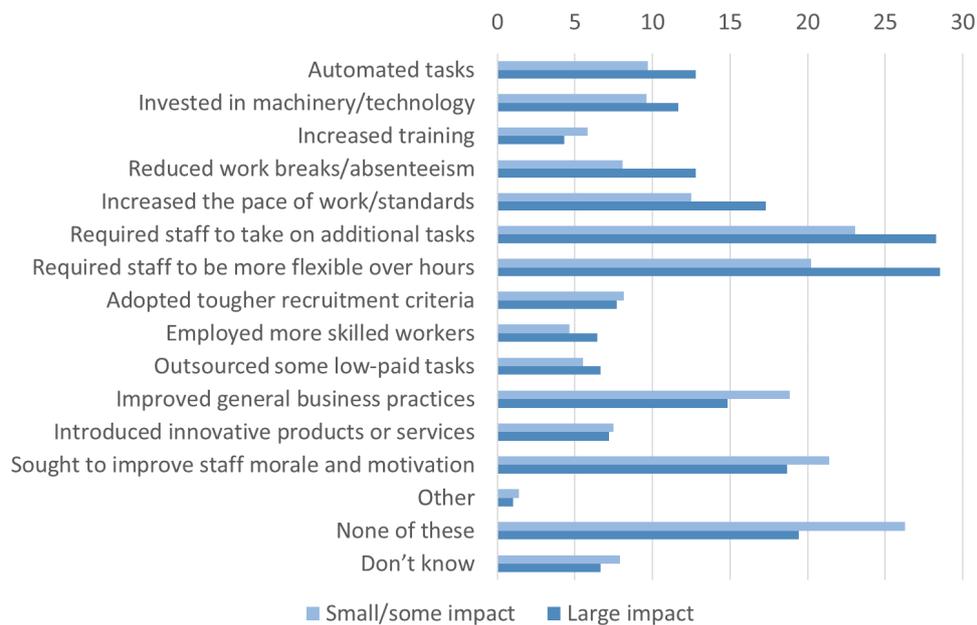
In 2019, 45% of NLW-affected organisations reported at least one of these four forms of work intensification (48% in 2018); 19% reported two or more (20% in 2018). Among those organisations reporting a large impact of the NLW in 2019, 51% reported at least one, with 27% reporting two or more.

Figure 11: Productivity-related responses to the NLW, by NLW exposure, 2018



Base: all organisations with some exposure to the NLW

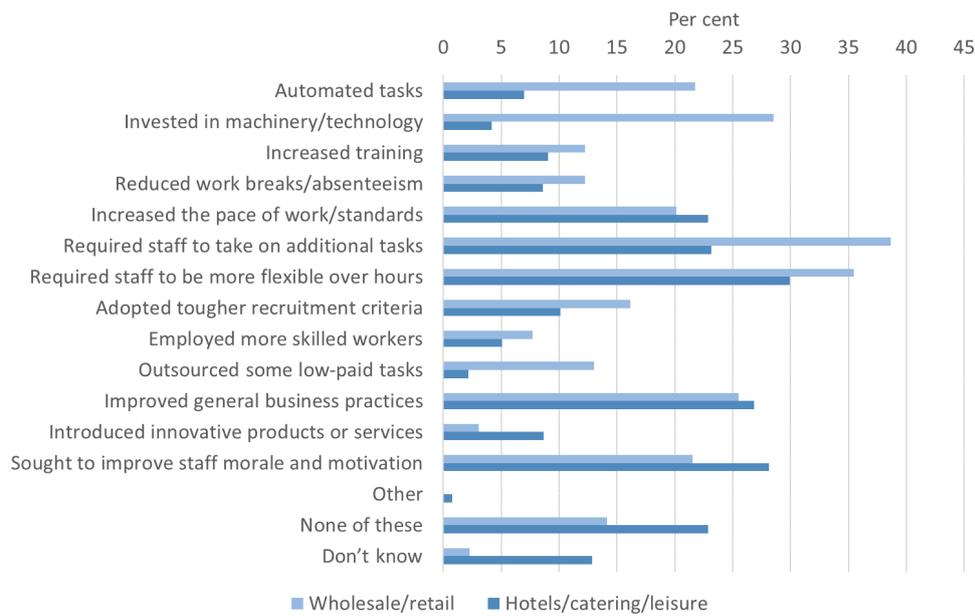
Figure 12: Productivity-related responses to the NLW, by NLW exposure, 2019



Base: all organisations with some exposure to the NLW

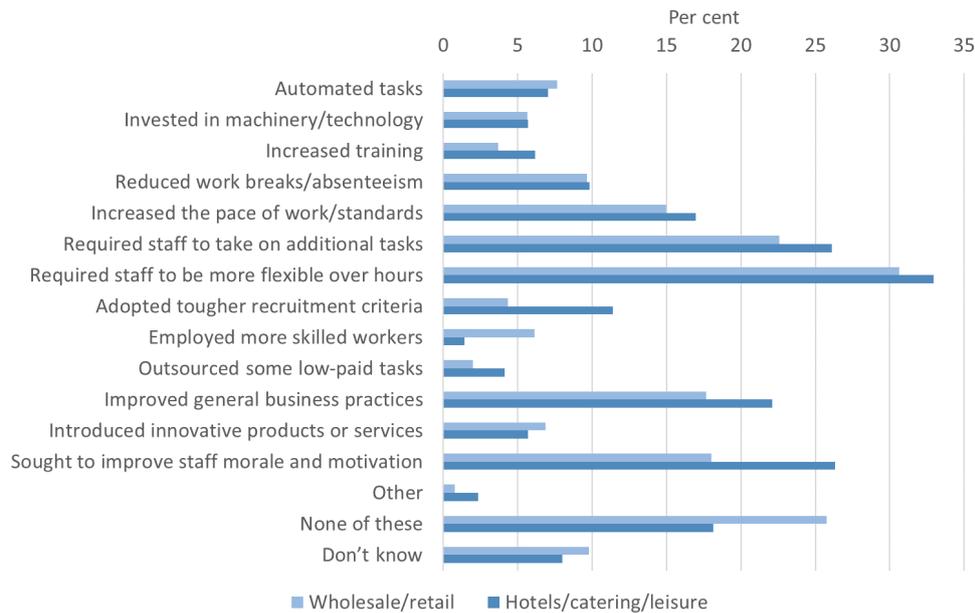
As in the previous section, we go further by looking at the different productivity-related responses shown in Figure 10 after focusing in on the two most exposed sectors: Wholesale/retail and Hotels/catering/leisure. Figure 13 reports data from the 2018 LMO and is striking in showing a considerably higher incidence of automation and capital investment in Wholesale/retail than in Hotels/catering/leisure. However, differences on the same items in the 2019 LMO are rather negligible (Figure 14), suggesting that it has not been a persistent strategy.

Figure 13: Productivity related responses to the NLW in Wholesale/retail and Hotels/catering/leisure, 2018



Base: all organisations in Wholesale/retail and Hotels/catering/leisure with some exposure to the NLW

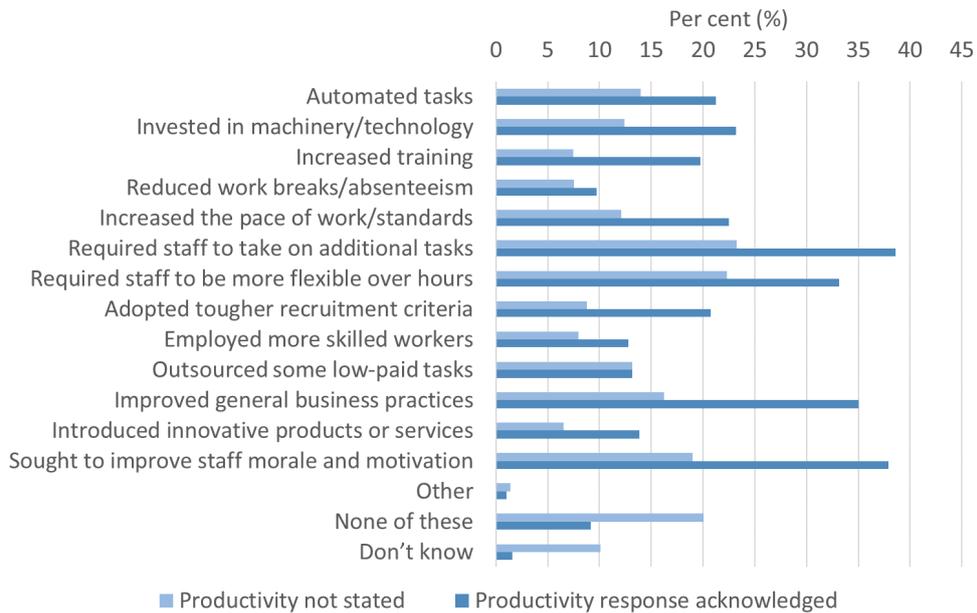
Figure 14: Productivity related responses to the NLW in Wholesale/retail and Hotels/catering/leisure, 2019



Base: all organisations in Wholesale/retail and Hotels/catering/leisure with some exposure to the NLW

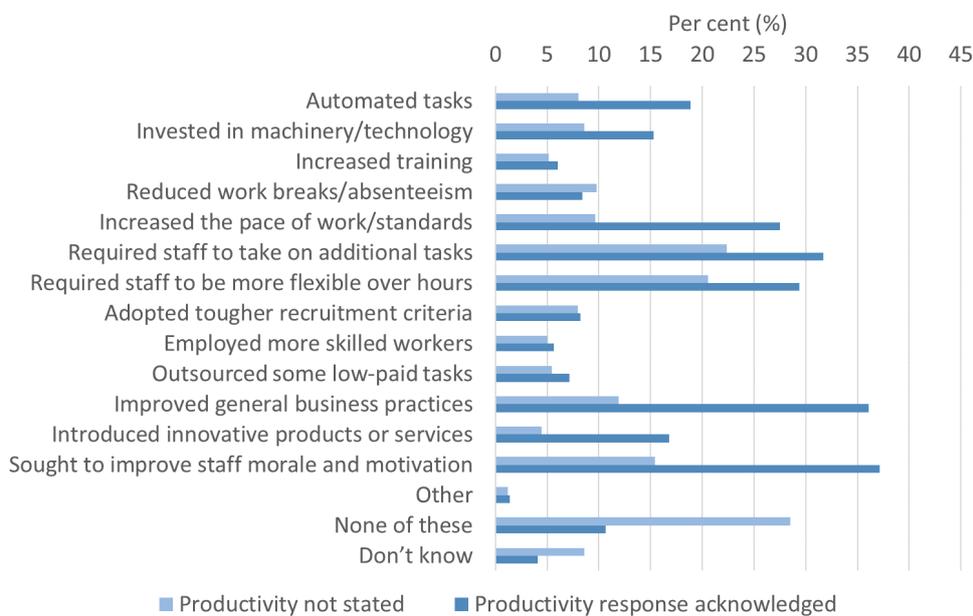
Finally, Figure 15 and Figure 16 tabulate responses by whether the firm voluntarily chose the ‘Raised productivity’ option at the previous question (see Figure 5). Those who voluntarily choose that option were more likely to report productivity-related responses than those who did not choose it. But many of those who did not choose the productivity option at the previous question nevertheless identified some form of productivity response at this question. This gives a clear indication that productivity responses are more widespread than Figure 6 and Figure 7 would suggest. What is not known is how significant (economically) these responses have been. This is what our matched LMO-FAME work seeks to investigate (see Chapter 3).

Figure 15: Productivity-related responses to the NLW, by whether productivity response acknowledged, 2018



Base: all organisations with some exposure to the NLW

Figure 16: Productivity-related responses to the NLW, by whether productivity response acknowledged, 2019



Base: all organisations with some exposure to the NLW

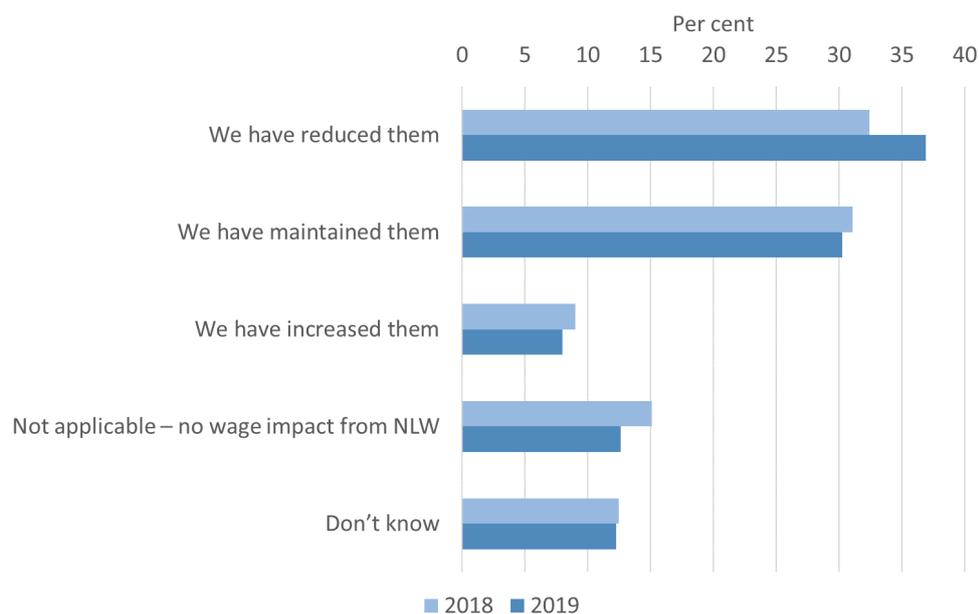
2.5 Impact on pay differentials

Respondents to the LMO surveys of 2018 and 2019 were asked how salary levels in their organisation had changed for staff earning above the NLW since its introduction. Figure 17 shows that around one third of NLW-exposed organisations had reduced differentials between NLW-affected staff and their supervisors/managers (32% in 2018 and 37% in 2019), whilst around three-tenths (31% in 2018 and 30% in 2019) had maintained them. The latter figure indicates that there have been some positive spillovers from the NLW on the wages of workers above the wage floor.

The group who answered 'Not applicable' are presumably those who were able to accommodate the NLW through other means (e.g. work intensification). Indeed, Figure 18 shows that a reduction in pay differentials was much more common in organisations where the introduction and uprating of the NLW had a 'large impact' on the wage bill than in organisations where the impact had been smaller.

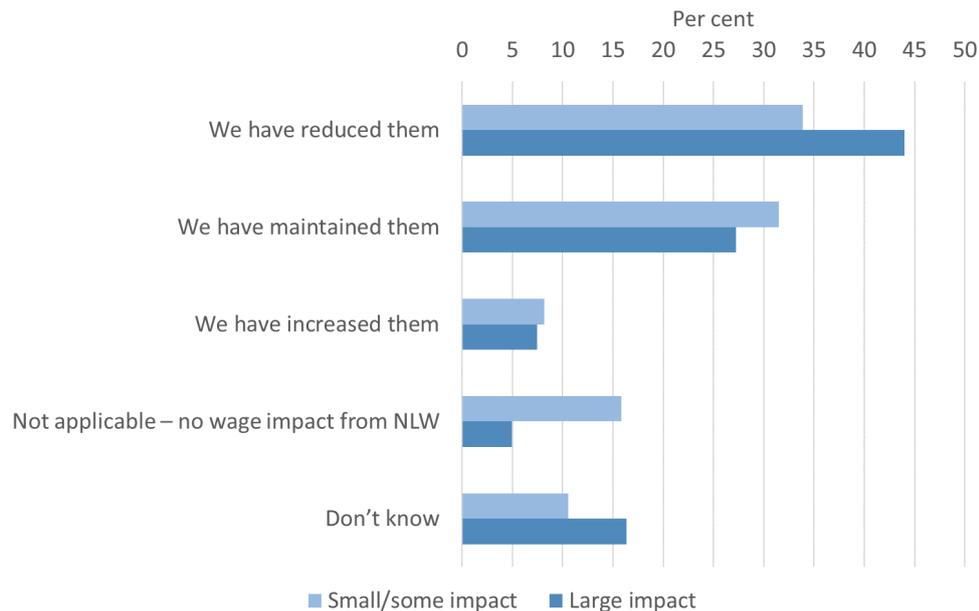
Among this group of heavily-exposed organisations, around one third (35% in 2019) reported having reduced pay differentials as well as reporting at least one of the productivity-related actions listed in Figure 10; a further tenth (9% in 2019) only reported reducing pay differentials and around two-fifths (39%) only reported productivity-related actions, with the remaining 17% reporting neither.

Figure 17: Impact on pay differentials between NLW staff and their supervisors/managers



Base: all organisations with some exposure to the NLW

Figure 18: Impact on pay differentials between NLW staff and their supervisors/managers, by NLW-exposure, 2019



Base: all organisations with some exposure to the NLW

Note: the pattern of responses was similar in 2018

2.6 Summary

The LMO surveys of 2015, 2018 and 2019 found a pattern of exposure to the NLW that was notably consistent across the three surveys, with just over half of all organisations seeing some impact on their wage bill, and around one in six finding that it had affected their wage bill “to a large extent”.

There was also a substantial degree of consistency in 2018 and 2019 in the responses that firms reported, with around three-tenths ‘taking lower profits’, one quarter of firms ‘raising productivity’ and one quarter ‘raising prices’. Other common responses included reducing overtime or bonuses and reducing headcount, either through redundancies or lower recruitment activity.

Further, more detailed enquiries about firms’ responses revealed a wider array of responses that could reasonably be considered under the heading of ‘raising productivity’, however. When all firms reporting exposure to the NLW were given an explicit list of possible productivity-related actions and asked whether they had undertaken any of these actions “in direct response to the increase in [their] wage bill caused by the introduction of the National Living Wage”, some 75% of firms affected by the NLW chose at least one action from the list in 2018, with 68% doing so in 2019, indicating that productivity responses are more widespread than previously thought.

The data on productivity responses suggests that many organisations’ response to the National Living Wage has been to intensify work or reorganise hours, with around one quarter of organisations having required staff to take on additional tasks, and a similar proportion having required staff to be more flexible in their hours of work; around one in seven had increased the pace of work or work standards. There was some evidence of organisations improving their business practices (e.g. quality control) or

seeking to improve staff morale and motivation, but a small minority (around one in ten) had automated tasks previously done by workers.

Around three-tenths of NLW-exposed organisations had maintained pay differentials between NLW-affected staff and their supervisors/managers since the introduction of the NLW, indicating some spillover effects from the NLW on the pay of workers higher up the wage distribution.

3 Analysis of LMO data linked to FAME

3.1 Introduction

The second element of the project matches the organisation-level data provided in the LMO surveys of Autumn 2015 and Summer 2018 to company accounts data obtained from FAME. The purpose is to be able to examine the comparative performance of NLW-exposed and non-exposed firms over the ensuing years. Performance is measured in terms of average labour costs, employment, productivity (value-added per employee), capital intensity and capital stock, and profitability (EBITDA margin). The CIPD LMO sample provides an indicator of NLW exposure, whilst the FAME dataset is used to obtain the indicated measures of firm performance.

The matching exercise is carried out on the set of LMO firms that: provided consent for their data to be used by the research team for policy evaluation purposes; provided either a company name or company registration number for matching; and which have company accounts data in the FAME database. Around one fifth (21%) of the 2015 LMO sample and three-tenths (28%) of the 2018 LMO sample could be matched to company accounts data from the FAME database on this basis, yielding a total linked sample of 787 firms, although the sample of firms for which we observe some key business outcomes such as labour costs and employment is around a quarter of this.

The results of this analysis should be treated with some caution due to small sample sizes. However, using a simple difference-in-differences set-up, comparing NLW-exposed and non-exposed firms over the pre-period 2013-2015 and the post period 2016-2018, we find that firms that reported being more affected by the NLW saw an increase in their average labour costs of around 2 per cent. We found no effects on firms' employment levels or profit margins. We found some evidence that firms may have increased capital investment in response to the NLW, which could have increased their labour productivity.

The remainder of this chapter describes the data matching process and analysis in more detail. Section 3.2 gives details of the consent and matching exercise, whilst Section 3.3 provides a validation analysis of the LMO measure of NLW-exposure. Section 3.4 then discusses attrition bias in the matching process. The analytical results of the difference-in-differences analysis are presented in Section 3.5, whilst Section 3.6 concludes.

3.2 The matching process and outcomes

Consent was not sought in the original LMO survey questionnaires, and so a separate exercise was undertaken in the Summer of 2019 in which the survey organisation that undertook the original 2015 and 2018 surveys (YouGov) re-contacted respondents to seek their consent to data matching. Among the 2015 survey sample, 417 out of 1037 companies provided consent, whereas in 2018 we received consent from 1011 companies (out of 2001 in the sample). Those who gave consent were asked to supply a company registration number, company name and company postcode to facilitate the match to FAME.

YouGov obtained contact details from 394 (38%) of the 1,037 respondents to the 2015 LMO and from 970 (48%) of the 2,001 respondents to the 2018 LMO. In Table 1 we present the overview of the outcome of the matching of these LMO firms to FAME data. Overall, we were able to match 56% and 58 % of these LMO observations in 2015 and 2018, respectively. Further validation of the accuracy of the matches (by industry codes – discussed later) results in slightly lower matching rates. Comparing

back to the original LMO samples, we have matches for 21% of the original sample in 2015 and 28% in 2018, and validated matches for 19% in 2015 and 24% in 2018.

Table 1: Overview of the LMO-FAME matching

	LMO 2015	LMO 2018
TOTAL OBSERVATIONS	1037	2001
with consent	417	1011
less duplicates	394	970
MATCHED - total	221	566
by CRN	58	155
by compname and postcode	63	155
by compname	100	256
VALIDATED - total	201	483
by CRN	58	155
by compname and postcode	63	155
by compname	80	173
Match rate (matched total as % of LMO obs with consent less duplicates)	56%	58%
Validation rate (validated cases as % of matched obs)	91%	85%

In Table 2 below we provide a more detailed description of the matching process. Table 2 breaks down the LMO observations by the information on each firm available in the survey (company registration number, postcode and company name) against the successful matching criteria (company registration number, company name and postcode or company name only).

Before proceeding to the description of the matching strategy it is important to explain how we have dealt with the fact that we observed companies with the same name (and no additional company registration number information) and different responses to NLW questions. For a few cases (17 in 2018 LMO and 8 in 2015 LMO) we could collapse into a single record all the observations with the same company name as they had identical responses to the NLW questions. Next, we investigated in detail cases where the company name was identical, but there were different NLW responses. Given these were relatively large companies (median employment was of 1000 or more), it is likely that the reason behind differential NLW responses was different reporting from more than one part of the

same company. Therefore, in cases where decisions had to be taken, we decided to retain the record with the positive responses to the NLW questions.

Our matching strategy had the following consecutive steps:

1. Match by company registration number (CRN)
2. If no match possible at step 1: match by company name and postcode
3. If no match possible at step 2: match by company name
 - a. Match by the exact name
 - b. Fuzzy match
4. If no match possible at step 3: additional match of the non-matched observations LMO performed by Bureau van Dijk (fuzzy match based on company name)

After the matching we have performed an additional validation exercise of the matches by comparing the industry overlap for the companies in the matched sample (described in more detail in the next paragraphs). Given the matching process results in a low number of matches we are inclined to include all of the matched observations in the analysis. However, we will flag the matched units for which there is no industry overlap between LMO and FAME for the sensitivity checks.

Table 2 documents the outcomes of our matching strategy. As it can be appreciated, in the left-hand panel of the table we match the majority of the observations with a valid company registration number, for both survey years. Out of those companies that do not provide any registration number, but only a company name and a postcode we match around half, either by postcode and company name, or by a company name only. Finally, out of those that provided company name only we again match around half of them.

In the process of matching steps 1-3 we have generated a list of companies present in either LMO survey that we were not able to match by any of our steps from 1 to 3. We have submitted the list of these companies' names along with postcodes (where available) to the Bureau van Dijk technical services who have performed on our behalf an additional match on the whole FAME database as they hold it on their servers. Their match was a fuzzy match on the company names. This step resulted in a batch of additional pairs of LMO-FAME companies. However, these matches were not helpful in increasing the size of our matched sample as they referred to matches that we have already recovered in our own linking process or they were not included in our FAME dataset, thus we could not use them in the analysis.

In the discussion of the quality of the match, validation is a necessary step. We would consider companies that have been matched based on the company registration number or on company name and postcode as good matches. However, when the match is reliant only on the company name (be it exact matching or a fuzzy match), ideally it should be validated against other available firm characteristics. The approach we have adopted in this exercise is to verify the industry overlap between the LMO and FAME data for the matched observations.

Table 2: Overview of the LMO-FAME matching steps

		Matched by:			Validated			Total Matched	Total Validated
		CRN	name+pcode	name (exact+fuzzy)	CRN	name+pcode	name (exact+fuzzy)		
LMO 2015 observations with:	Total obs	No.	No.	No.	No.	No.	No.	No.	No.
Compname, CRN, postcode	80	57	8	3	57	8	3	68	68
Compname, CRN	1	1	0	0	1	0	0	1	1
Compname, postcode	216	0	55	50	0	55	39	105	94
Compname	97	0	0	47	0	0	38	47	38
Total	394	58	63	100	58	63	80	221	201
LMO 2018 observations with:	Total obs	No.	No.	No.	No.	No.	No.	No.	No.
Compname, CRN, postcode	233	150	9	11	150	9	5	170	164
Compname, CRN	5	5	0	0	5	0	0	5	5
Compname, postcode	526	0	146	130	0	146	92	276	238
Compname	206	0	0	115	0	0	76	115	76
Total	970	155	155	256	155	155	173	566	483
TOTAL BOTH SURVEYS	1364	213	218	356	213	218	253	787	684

Therefore, we would mark as validated all matches based on an overlapping company registration number or company name and postcode. For the matches based on the company name only, we would additionally require that there is a minimum overlap between LMO and FAME industries. In detail, we would accept a name-based match if:

- LMO industry is identical to FAME industry
- LMO industry is non-missing and FAME industry is missing
- LMO industry is “Voluntary/3rd sector”
- LMO industry is “Professional/scientific services” or “Administrative/support services” and FAME industry is NOT within “Agriculture/forest/fishing”, “Mining/extraction”, “Manufacturing”, “Energy/water” or “Construction”
- FAME industry is “All professional/scientific services” and “Administrative/support services” and LMO industry is NOT within “Agriculture/forest/fishing”, “Mining/extraction”, “Manufacturing”, “Energy/water” or “Construction”
- FAME industry is within “All other services”
- FAME industry is “Activities of private households” and LMO industry is “Health/social care” or in “Education”

In Table A1 in the Appendix we illustrate these rules graphically. Each green cell refers to a match that we would accept as ‘validated’ in the sample of cases matched only on company name; each orange cell refers to a case which we would flag as ‘non-validated’ in the final sample.

For the subset of matches that were matched based on company registration number or on company name and postcode (431 observations in both years) we find that our industry validation rules are passed in 83% of cases (see Table 3 below). For the remaining 17%, it could be that these non-validated firms have just misreported their industry codes. Also, it is not uncommon that companies have difficulty in precisely pin-pointing their industry codes. For the subset of matches that were matched based on company name – we could validate 71%.

Table 3: The overview of industry validation by the match type

	CRN or cname+postcode matches		Cname matches	
	Count	Percentage	Count	Percentage
Validated	357	83%	253	71%
Non-validated	74	17%	103	29%

In summary, our final sample is composed of 221 matched cases in 2015 and 566 in 2018 (Table 1).

3.3 Validating the LMO measure of NLW-exposure

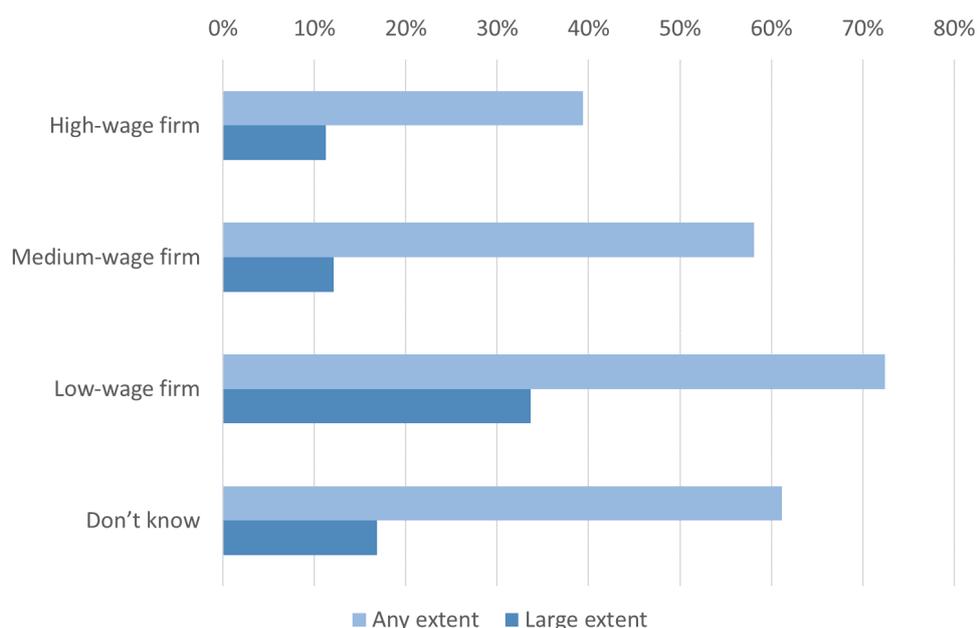
In any analysis that we are able to conduct on the matched sample, it is important that we have confidence in the LMO measure of NLW exposure. We have already commented on the extent to which NLW-exposure as measured in the LMO corresponds to the expected bite of the NLW by industry (see Figure 3 and the associated discussion). We are also able to carry out two other validation exercises, as follows.

3.3.1 Comparison with average wage costs

In the 2018 LMO, we can compare the NLW exposure measure with the respondent's view of whether the organisation is a high/low wage organisation (Figure 16). We see that both exposure indicators are monotonically increasing as we move down the wage-level indicator from high-wage to low-wage.

This wage-level indicator remains correlated with NLW exposure when we add it alongside size, industry, ownership and region in a simple regression analysis (F-statistic of 11 ($p < 0.001$) in a regression of 'Any exposure' and an F-stat of 7 ($p < 0.001$) in a regression of 'Large exposure').

Figure 19: Exposure to the NLW by high/low wage organisation



Base: all organisations with two or more employees in the UK

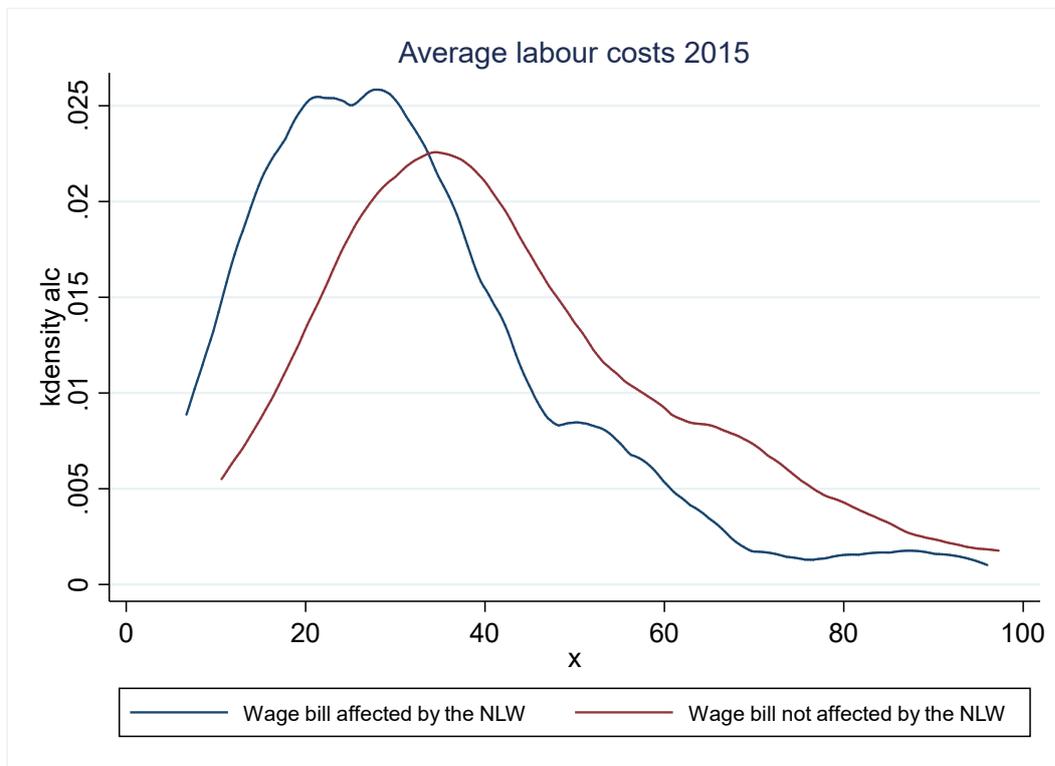
It is reassuring that most low-wage firms report some impact from the NLW, and that a sizeable minority (around one third) report a large impact. The share of high-wage firms reporting some impact is perhaps surprisingly high at around 40%, but recall the earlier chart which showed reasonable levels of exposure to the NLW even in high-wage sectors such as Finance (even investment banks have administrative assistants). It is also feasible that some firms responded to the wage-level question through reference to their sector (e.g. a retail firm may report itself to be high-wage for its sector, even though it may be a low-wage firm when set alongside other sectors).

3.3.2 Comparing the LMO exposure indicator with average wage costs in FAME.

Once we completed the matching and validation process, we matched our final sample to the FAME data in order to learn more about the characteristics of the companies exposed to NLW changes. In Figure 20 we plot the distribution of average labour costs in 2015 (remuneration divided by employment) for the companies that in either 2015 or 2018 reported that their wage bill was or would be affected by the NLW to any extent (i.e. those responding "Yes, to a large extent", "Yes, to some extent" or "Yes, to a small extent") and separately for the companies that claimed to be unaffected.

As it can be seen in Figure 20, and as expected, the firms that suggest they were affected or would be affected by the NLW display on average lower labour costs.

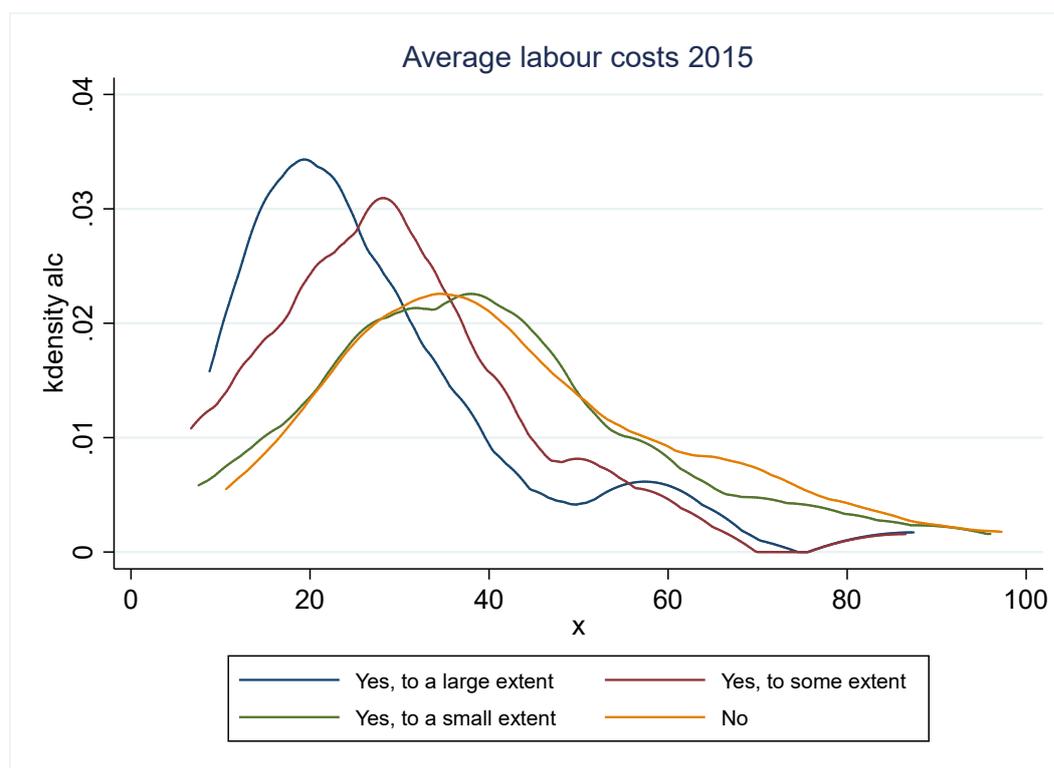
Figure 20: Average labour costs distribution: exposed and non-exposed firms



Sample: 110 firms with wage bill affected by the NLW and 96 firms with wage bill not affected by the NLW

In Figure 21 we plot the distribution of average labour costs in 2015 for four separate groups of firm, distinguished by the degree to which they report being affected by the NLW. Reassuringly, the distribution shifts further to the left (lower average labour costs) the more exposed to the NLW firms report to be. It is also clear from Figure 21 that firms who reported being affected to some or to a large extent by the introduction of the NLW are distinct from those who reported being affected to a small extent or not at all, with the latter groups representing a much lower incidence of low pay than the former.

Figure 21: Average labour costs distribution: by degree of exposure to the NLW



Sample: 37 firms with wage bill affected to a large extent; 44 firms with wage bill affected to some extent; 29 firms with wage bill affected to a small extent; 96 firms with wage bill not affected by the NLW.

3.3.3 Comparison of exposure in 2015 and 2018

Finally, we have around 80 respondents that are common across our two LMO-FAME matched samples. We can compare their 2015 and 2018 responses to gauge the level of correspondence between the two. There could be some natural variation, but consistency is expected and would give confidence in the exposure indicator.

We find that some 65% of respondents gave exactly the same response in both years. 85% gave the same response or moved only one point on the scale. If we set 'Don't know' responses to one side, the polychoric correlation between the 4-item score in 2015 and the equivalent in 2018 is 0.75.

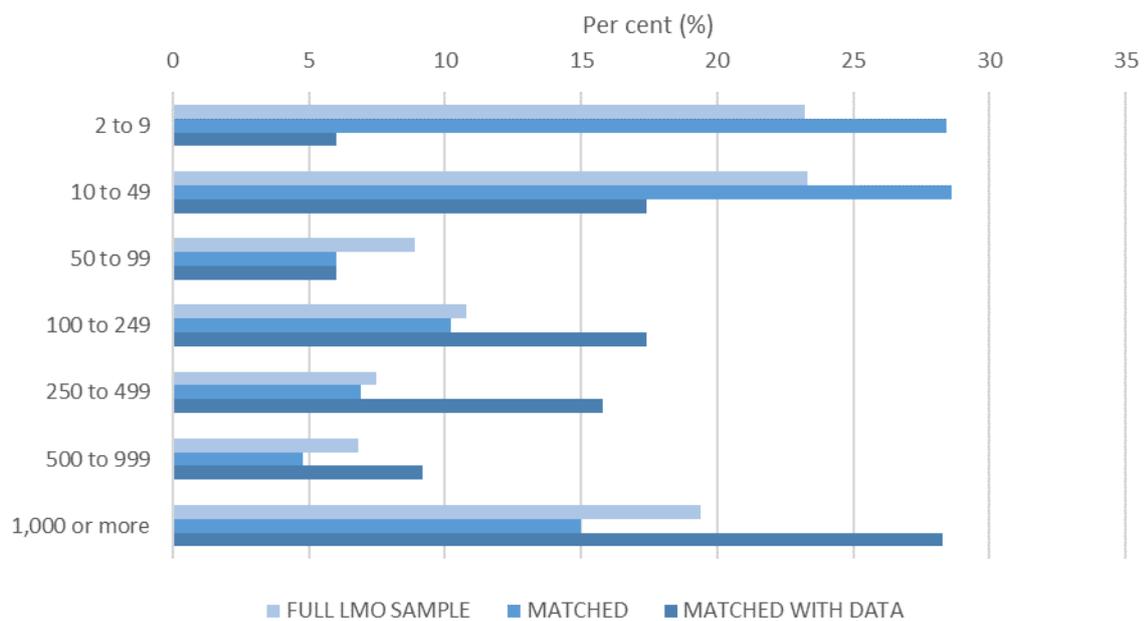
3.4 Attrition bias in the matching process

Clearly, in any matching exercise of this nature, one is concerned to evaluate the extent to which the subset of cases with linked data are representative of the original starting sample. We present some analysis of that issue here, showing the profile of: (i) the full LMO 2018 sample; (ii) the subset of cases that have been matched to FAME and have some data items of interest (typically the value of fixed assets); (iii) the subset of those cases that also have data on other items of interest (e.g. employment). It is samples (ii) and (iii) that we would rely on in any analysis of the effects of the NLW.

The Figures below show that there are some differences in the profiles of these three samples – notably by size, with matched firms including data being much larger than the full LMO sample reflecting differential Companies House reporting requirements for firms in different size bands

(Figure 22).³ There is also a higher prevalence of firms in the voluntary or third sector in the matched sample including data (Figure 23). These differences can potentially be corrected using weights for the purposes of descriptive analysis; they can also be accommodated in any regression analysis by including demographic variables as covariates. The regional distribution of the three samples is similar (Figure 24), although a larger proportion of firms in the matched sample with data report operating across all of the UK; again this reflects the nature of Companies House reporting requirements for firms in different size bands. It is reassuring to note that the profile of NLW exposure is similar across all three samples (Figure 25 and Figure 26). However, there is a lower incidence of automation responses to the NLW in the matched sample including data (Figure 28).

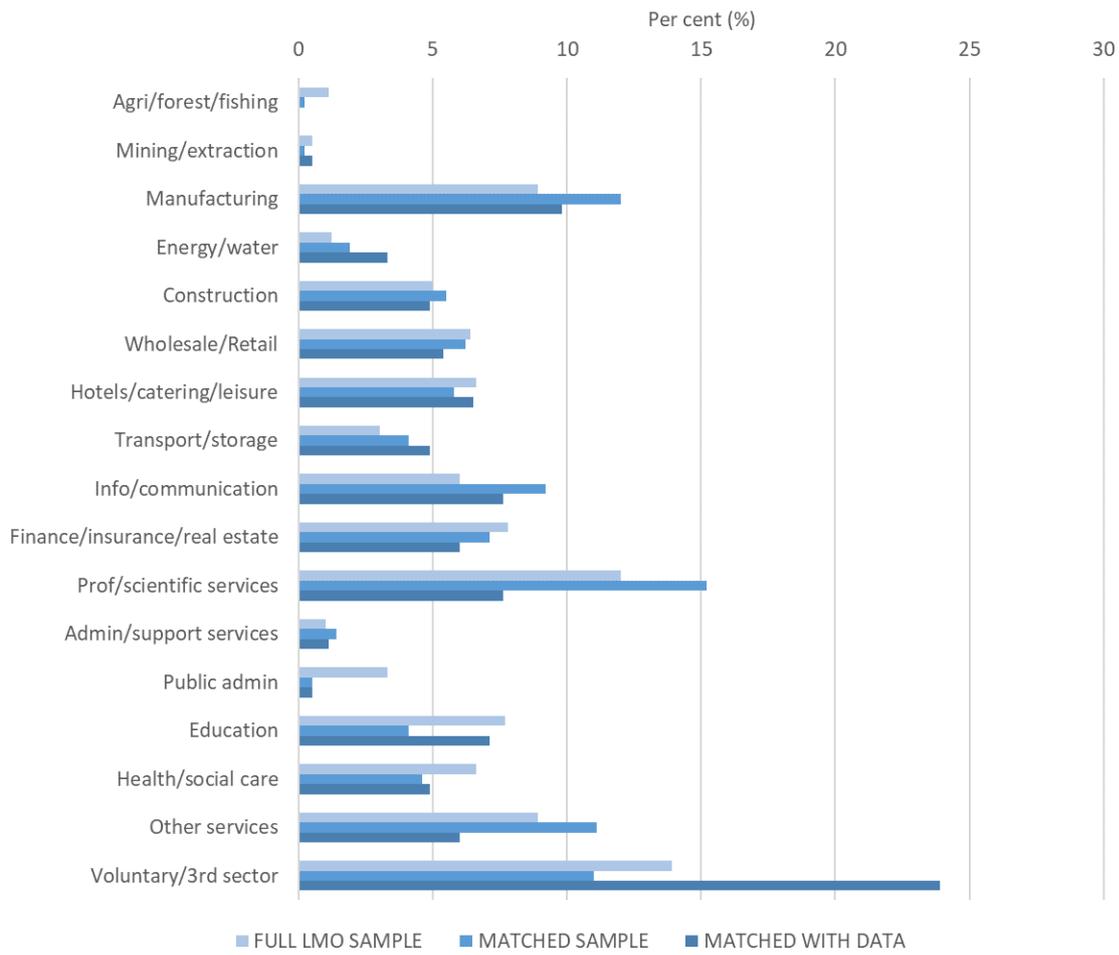
Figure 22: Comparison of full LMO and LMO-FAME samples: firm size distribution (in %)



Sample as indicated

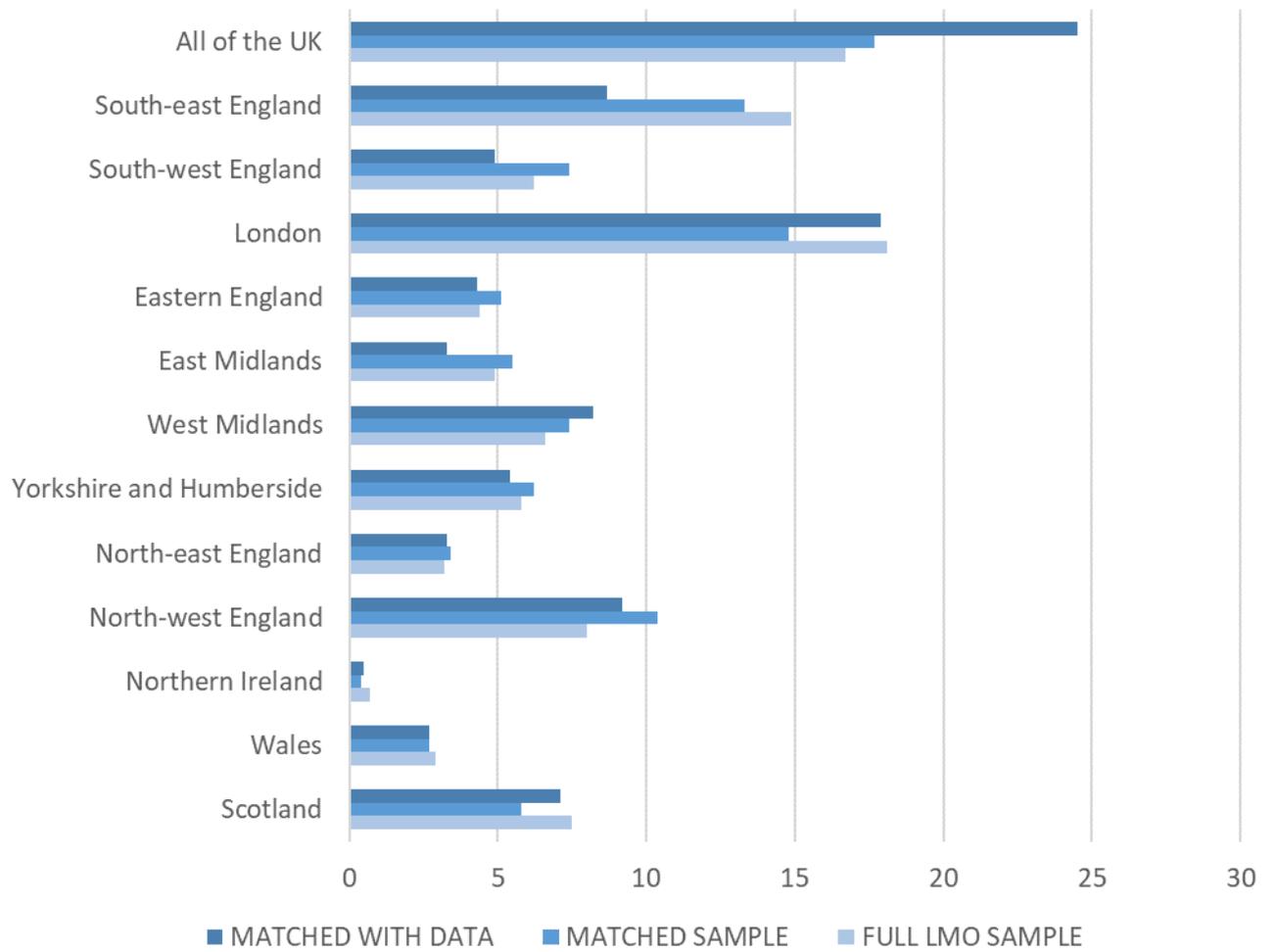
³ Using the mid-points of the size intervals shown in Figure 22 and setting the size of firms with 1000 or more employees equal to the size of the median firm in this category from the matched sample, we can approximate a simple average firm size for the three samples: FULL LMO SAMPLE=1040, MATCHED=750, MATCHED WITH DATA=1410. Using this same approach, the simple average firm size for the sample MATCHED WITHOUT DATA is 440.

Figure 23: Comparison of full LMO and LMO-FAME samples: industry distribution (in %)



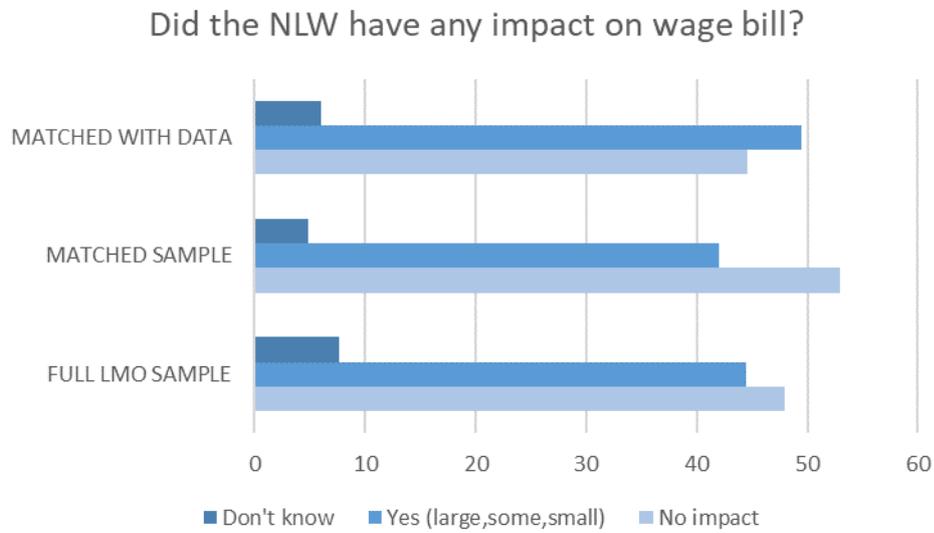
Sample as indicated

Figure 24: Comparison of full LMO and LMO-FAME samples: regional distribution (in %)



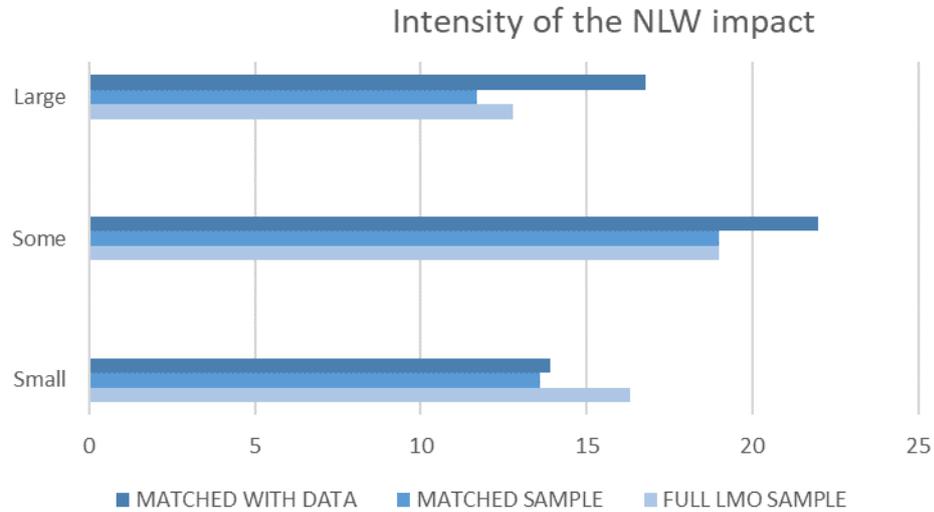
Sample as indicated

Figure 25: Comparison of full LMO and LMO-FAME samples: impact of NLW (in %)



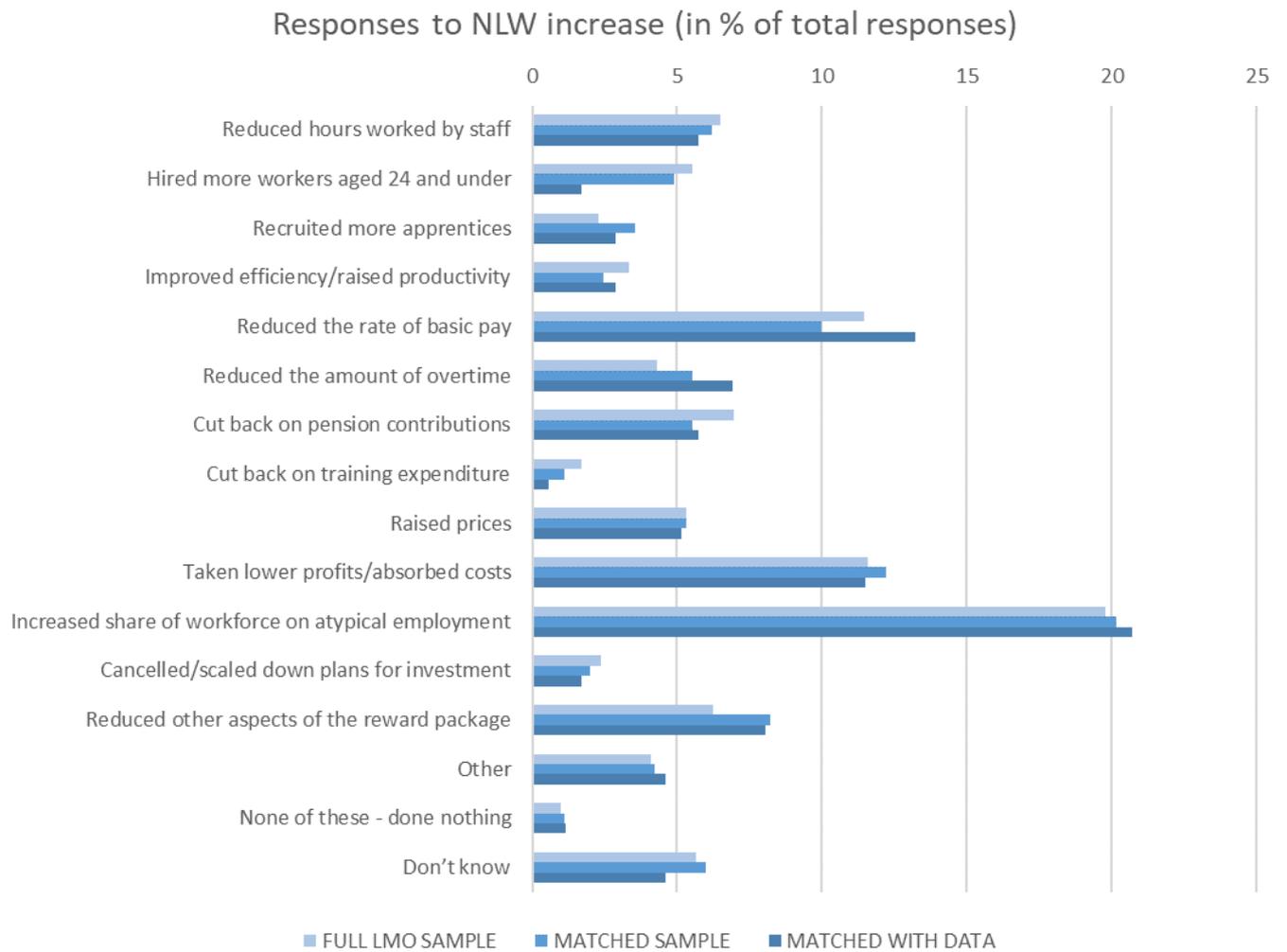
Sample as indicated

Figure 26: Comparison of full LMO and LMO-FAME samples: the intensity of the NLW impact (in %)



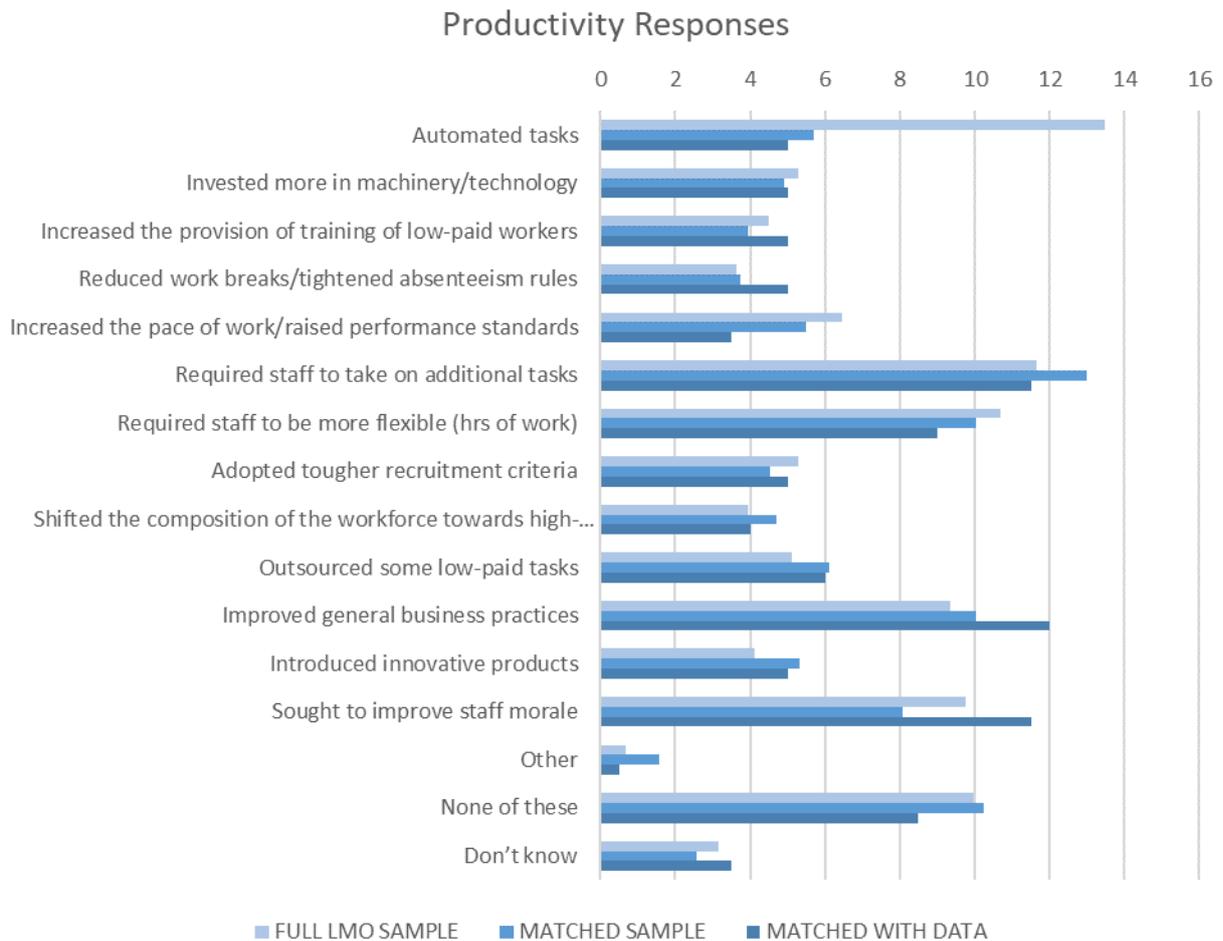
Sample as indicated

Figure 27: Comparison of full LMO and LMO-FAME samples: the responses to the NLW change (in %)



Sample as indicated

Figure 28: Comparison of full LMO and LMO-FAME samples: the productivity responses to the NLW change (in %)



Sample as indicated

3.5 Analytical results using the matched data

In this section we use the matched LMO-FAME sample to compare outcomes for firms that report being differentially affected by the NLW. However, we have to acknowledge that the size of the sample (a maximum of around 790 firms across the two LMOs) is small, particularly when one focuses on those organisations (around one in six) for whom the NLW had a large effect. These are the organisations which can be expected to have the largest – and thus the most observable – productivity or other responses.

We face the additional hurdle that FAME does not offer complete information for many firms. Capital stocks are well populated and so we are likely to have most success in analysing patterns of investment. However, many firms have missing information on employment, and so the samples available for the analysis of average labour productivity are particularly small in view of the modest size of the starting sample available to us. Specifically, our matched sample of around 800 firms falls

to around 200 once we condition on full information in FAME; this necessarily yields a small treatment group.⁴

In our analysis we distinguish between firms that reported being affected to some or to a large extent by the introduction of the NLW (the treated) and those who reported being affected to a small extent or not at all (the controls). This distinction is informed by the analysis in the previous section. This showed (see Figure 21) that the distribution of average labour costs for firms reporting that their wage bill was affected by the NLW to a small extent was very similar to that for firms reporting not being affected at all by the NLW. In contrast, firms reporting that their wage bill was affected by the NLW either to some or to a large extent tended on average to have significantly lower average labour costs than other firms, as we might expect.⁵ Table 4 shows the firm counts in each of the treatment and control groups by year in our matched sample. Here we constrain the sample to include firms for whom we were able to cross-validate the industry information in the two data sources and for whom we have full information on our outcomes of interest. As shown in Table 4, we have 71 firms in the treatment group and 123 firms in the control group. In individual years these numbers are slightly smaller because firms may enter and exit the sample for which we have full information. These numbers do not include firms who appear in the matched data exclusively before or exclusively after the announcement of the NLW in Spring 2015. Note that when we focus on the matched and validated sample of firms for whom we observe fixed assets, but for whom we may not observe employment and other outcome variables, we have 156 treated firms and 365 control firms (not shown in Table 4).

We use a simple difference-in-differences set-up to evaluate the effect of the NLW on firm outcomes. The pre-period is 2013-2015 and the post period is 2016-2018. The treatment indicator is an indicator of whether a firm reported being affected to some or to a large extent by the introduction of the NLW.⁶ More precisely we estimate the following equation:

$$Y_{it} = DID * POST_t * NLW_i + YEAR_t + \delta_i + \beta X_{it} + \varepsilon_{it}$$

In this equation Y_{it} denotes the outcome of interest (e.g. average labour costs, employment, average labour productivity or fixed assets), the $YEAR_t$ are a set of year dummies that pick up time-varying factors that influence treatment and control firms the same, the δ_i are firm specific fixed effects which will capture any time-constant firm characteristics, the X_{it} are factors that vary across firms and across time (we consider industry specific trends), and ε_{it} is an error term. $POST_t$ is an indicator of the post NLW announcement period and NLW_i is an indicator variable equal to one if a firm has responded that its labour costs are affected to some or a large extent by the NLW and zero otherwise. The

⁴ One possible way forward – suggested at the LPC Research Symposium – is to use the LMO-FAME sample to predict NLW exposure (using the LMO exposure indicator in conjunction with organisation characteristics from FAME), and then to model NLW-exposure in the broader FAME dataset. This would enable the creation of a proxy exposure indicator in FAME, potentially widening the sample. While this option may be worthwhile exploring, the fact that our matched sample contains only a small number of organisations means that any predicted probability is going to be generated from a relatively small number of cases (and will again be hamstrung by the paucity of employment data in FAME). A further option is to seek to extend the LMO-FAME matched sample by including the 2019 LMO. This would again entail going back to respondents to seek their consent to matching and to obtain contact details. However, the approach is now tried and tested, thus we would expect this exercise to boost sample numbers significantly.

⁵ The sample of firms reporting that their labour costs were affected by the NLW to a large extent is too small to analyse separately.

⁶ We also consider an experiment where the treatment indicator is an indicator of whether a firm reported being affected to a small, some or large extent by the introduction of the NLW. In this case we find no significant effects of the NLW on firms' average labour costs, as might be expected on the basis of Figure 21.

coefficient of interest is *DID*, which captures the difference-in-differences estimate of the effect of the NLW on outcome *Y*. We estimate this equation using robust regression to control for outliers in the data and cluster standard errors by firm.⁷

Table 4: Business observations by year and NLW status: Validated sample with full information

Financial year	Control firms	Treatment firms	Total
2012-13	102	63	165
2013-14	114	64	178
2014-15	115	68	183
2015-16	117	70	187
2016-17	118	66	184
2017-18	81	57	138
Total firm-year observations	647	388	1035
Total firms	123	71	194

In Table 5 we report estimates of *DID*, the effect of the NLW on businesses in our sample. We consider effects on firms' average labour costs, employment, productivity (value-added per employee), capital intensity, capital stock and profitability (EBITDA margin). We report effects estimated on three samples: Models 1 and 2 are estimated on the matched LMO-FAME sample; Models 3 and 4 are estimated on the validated (on industry) matched LMO-FAME sample; Models 5 and 6 are estimated on the validated matched LMO-FAME sample for which information on all outcome variables is available (the sample described in Table 4). When we use all available observations for the particular performance indicator we consider (Models 1-4), sample sizes vary across performance measures. For example, capital assets are often reported in company accounts where outcomes such as employment and remuneration may not be. We note that sample sizes are small, and hence that these results should be interpreted with a lot of caution.

Looking first at Model 1 in Table 5, we find a 2 percent increase in average labour costs associated with exposure to the NLW. This is statistically significant at the 5 per cent level and changes very little when we estimate this on the validated sample (Model 3) or the sample with full information (Model 5).⁸ In Model 2 we include industry-year effects, which do not affect the estimated effect of the NLW

⁷ We use a two-step procedure. First we estimate the model using robust regression. We then obtain standard errors by estimating the model using OLS with the weights from the robust regression and clustering on firms. This yields larger standard errors than robust regression alone.

⁸ Note that this effect is the increase in average labour costs arising because of the NLW and comes on top of changes in average labour costs arising for other reasons. The 2 per cent increase is smaller than the estimated effect of the NLW on low paid workers. For example, Aitken, Dolton and Riley (2019) find that the introduction of the NLW increased the wages of low paid workers by 4-7 per cent in 2016 and by another 0.8-1.4 per cent in

on average labour costs. However, when we include industry-year effects in the validated samples (Models 4 and 6) the estimated effect of the NLW on average labour costs reduces to 1.5 per cent and is no longer statistically significant. This is to be expected because of significant differences in exposure to the NLW across industries and because of the small estimation sample; i.e. the industry-year effects will pick up some of the effect of the NLW.

Table 5: Difference-in-differences estimates of the effects of the NLW

		(1)	(2)	(3)	(4)	(5)	(6)
Average labour costs	Coeff	0.020**	0.022**	0.022**	0.013	0.022**	0.015
	SE	[0.010]	[0.011]	[0.010]	[0.012]	[0.010]	[0.012]
	Obs	1277	1277	1147	1147	1035	1035
Employment	Coeff	-0.002	-0.001	0.000	-0.005	-0.001	-0.005
	SE	[0.016]	[0.015]	[0.016]	[0.017]	[0.017]	[0.018]
	Obs	1314	1314	1176	1176	1035	1035
Labour productivity	Coeff	0.031	0.023	0.033	0.015	0.029	0.012
	SE	[0.020]	[0.021]	[0.021]	[0.022]	[0.021]	[0.021]
	Obs	1205	1205	1083	1083	1035	1035
Capital per head	Coeff	0.030	0.065**	0.016	0.053	0.015	0.069**
	SE	[0.031]	[0.032]	[0.033]	[0.033]	[0.034]	[0.034]
	Obs	1260	1260	1133	1133	1035	1035
Capital	Coeff	0.073***	0.062***	0.054**	0.044*	0.041	0.042
	SE	[0.021]	[0.023]	[0.022]	[0.025]	[0.027]	[0.027]
	Obs	3109	3109	2743	2743	1035	1035
Profit margins	Coeff	0.005	0.003	0.004	0.002	0.005	0.001
	SE	[0.010]	[0.011]	[0.011]	[0.012]	[0.011]	[0.012]
	Obs	1241	1241	1114	1114	1035	1035
Industry trends		No	Yes	No	Yes	No	Yes
<i>Sample features</i>							
Industry validation		No	No	Yes	Yes	Yes	Yes
Full information		No	No	No	No	Yes	Yes

Notes: Outcome variables estimated in logs, except profit margins. Firm fixed effects included in all models. Robust regression. Standard errors clustered by firm. Models 1 and 2 estimated on the matched LMO-FAME sample. Models 3 and 4 estimated on the validated (on industry) matched LMO-FAME sample. Models 5 and 6 estimated on the validated matched LMO-FAME sample for which information on all outcome variables is

2017. Evaluated on average over the three years after the announcement of the NLW in 2015 this corresponds to an increase in the wages of low paid workers of around 4 per cent, or twice the effect we find on firms' average labour costs. The smaller effect of the NLW on firms' average labour costs than on low paid employees is consistent with the fact that in addition to the remuneration of low paid workers, firms' labour costs include the remuneration of better paid employees that are not directly affected by the NLW.

available. Industry trends estimated by including industry specific year dummies. Observations refer to firm-year observations.

The results in Table 5 suggest there is no effect of the NLW on firms' employment levels or profit margins. As we do not find any effects of the NLW on employment levels, the estimated effect of the NLW on average labour costs comes about via its effect on total labour costs. The rise in total labour costs is not reflected in a decrease in profit margins, which implies that firms in our sample have either offset the rise in total labour costs from the NLW by increases in prices or increases in labour productivity. We find that firms that were more exposed to the NLW increased their capital assets more than other firms. The estimated effect in Model 1 is quite high (in comparison to the labour cost effect) at 7.3 per cent. This effect falls to 4.4 per cent in Model 4 estimated on the validated sample and including industry-year effects. When we constrain the sample of firms to include only firms that have full information, the estimated effect of the NLW on capital stocks remains just above 4 per cent, but the effect is no longer statistically significant at conventional levels (p -value = 0.12) reflecting the significantly smaller sample size. These effects on capital stocks are reflected in increases in capital intensity (capital per head) in the models where we allow for industry-year effects (Models 2, 4 and 6). There is some evidence that these changes in capital intensity may have influenced average labour productivity (measured here as valued added per head, where value added is proxied as the sum of profits, depreciation and remuneration)⁹. The estimated coefficients on average labour productivity are positive; around 3 per cent in the models where we exclude industry-year effects. These effects may reflect rising labour productivity through increased investment or increases in prices in response to the NLW. However, partly reflecting small sample sizes, standard errors are high and these effects are not statistically significant.

3.6 Summary

Around one fifth (21%) of the 2015 LMO sample and three-tenths (28%) of the 2018 LMO sample could be matched to company accounts data from the FAME database using information on the company registration number or company name and postcode. This matching process yielded a total linked sample of 787 firms. The sample of firms for which we can actually observe key business outcomes such as labour costs and employment is around a quarter of this. Comparing the 2018 LMO sample to the matched LMO-FAME sample we find that the distribution of firm characteristics and NLW responses is similar in many respects, but there were also differences. The matched sample for which we observe detailed accounting information is skewed towards larger firms. This is due to different Companies House reporting requirements for different size firms.

This linked sample was used to compare outcomes for firms that were differentially impacted by the introduction of the NLW. We distinguished between firms that reported that their wage bill was affected to some or to a large extent by the introduction of the NLW (the treated) and those who reported that their wage bill was affected to a small extent or not at all (the controls), using a simple difference-in-differences set-up to evaluate the effect of the NLW on firm outcomes. The pre-period was 2013-2015 and the post period was 2016-2018. We found that firms that reported being more affected by the NLW saw an increase in their average labour costs of around 2 per cent. We found no effects on firms' employment levels or profit margins. We found some evidence that firms may have

⁹ We winsorize the bottom 4 per cent of the sample of average labour productivity to avoid discarding negative values when estimating in log form; equivalently we also winsorize the top 4 per cent of average labour productivity observations.

increased capital investment in response to the NLW, which could have increased their labour productivity. The results of this analysis should be treated with some caution due to small sample sizes.

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Appendix

Table A1: Industry validation rules: green cells refer to accepted matches, orange refer to the non-validated ones.

	LMO industries:															
	Agri/forest/ fishing	Mining/ extraction	Manuf.	Energy/ water	Constr- uction	Wholesale/ Retail	Hotels/ catering/ leisure	Transport/ storage	Info/Comm	Finance/ insurance/ real estate	Prof/ scientific	Admin/ support	Education	Health/ social care	Other services	Voluntary/ 3rd sector
FAME industries:																
Agri/forest/fishing	Green	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Mining/extraction	Orange	Green	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Manufacturing	Orange	Orange	Green	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Energy/water	Orange	Orange	Orange	Green	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Construction	Orange	Orange	Orange	Orange	Green	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Wholesale/retail	Orange	Orange	Orange	Orange	Orange	Green	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Hotels/catering/ leisure	Orange	Orange	Orange	Orange	Orange	Orange	Green	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Transport/storage	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Info/comms	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Orange	Green	Green	Orange	Orange	Orange	Green
Finance/insurance/real estate	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Green	Orange	Orange	Orange	Green
Prof/sci. services	Orange	Orange	Orange	Orange	Orange	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Admin/support services	Orange	Orange	Orange	Orange	Orange	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Education	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Green	Orange	Orange	Green
Health/social care	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Green	Green	Green	Green
Other services	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Orange	Orange	Green
Priv households	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green	Green	Orange	Green
Ext bodies/org	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Green
Missing SIC	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green