Final Report

The Impact of the National Living Wage on the Adult Social Care Sector in England in the Context of COVID-19 Pandemic and Brexit

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Executive Summary

The aim of this report is to examine the impacts of the National Living Wage (NLW) in a low-wage sector, the adult social Care (ASC) sector in England, in the recent context dominated by the COVID-19 pandemic and the introduction of the new trade relationship of the UK with the EU (Brexit). The main objectives are to estimate the independent effects of the NLW, COVID-19, and Brexit on a range of care homes' outcomes, as well as to investigate the extent to which these forces interactively impacted on these outcomes.

Our methodology applies a differential trend-adjusted Difference-in-Differences (DID) estimator on a linked quarterly panel data set, including information on employees and care homes in the ASC sector in England between December 2019 and June 2021. The data set includes detailed workforce and employers' information from the Adult Social Care Workforce Data Set (ASC-WDS), linked with information on deaths due to COVID-19 across local authorities in England from the Office of National Statistics (ONS), and deaths due to COVID-19 across care homes from the Care Quality Commission (CQC), the body regulating the ASC sector in England.

We find that, on average, NLW increases in April 2020 and April 2021 had a positive and significant effect on care homes' wage growth, but no significant effect on employment and hours. Our results also suggest that the NLW led to a significant decrease in employees' absenteeism and training, as well as to significant increases in deaths due to COVID-19 at the care home level, but also at the area level, due to spill-over effects.

A novel finding of our analysis is that NLW effects are heterogeneous and depend on the impact of COVID-19 in the locality care homes operate, as measured by the change in deaths due to COVID-19, and the impact of Brexit at the care home, as measured by the share of EU employees in the care home's total employment. We find that care homes in areas with higher increases in deaths due to COVID-19, wage growth and reductions in training, triggered by the NLW, were smaller in magnitude, whereas growth in deaths due to COVID-19 at the care home, linked to the NLW, was larger. Moreover, our results suggest that in care homes with higher share of EU employees, there were smaller reductions in employees' absenteeism, larger reductions in staff training, and smaller increases in deaths due to COVID-19 at the care home.

Our findings suggest three potential explanations of the insignificant employment effect of the NLW: the first is that NLW effects on wage growth are small; the second is that other adjustments to the NLW, such as decreases in employees' absenteeism and training, and deterioration of quality of care, as suggested by increases in deaths due to COVID-19, offset the higher wage costs; and the third explanation is related to imperfect competition/monopsony considerations in the ASC labour market supported by evidence that employment growth was the lowest among care homes seen the lowest wage growth as a result of NLW, which is suggestive of labour supply responses to the NLW.

Finally, we find evidence that COVID-19 and Brexit, apart from moderating NLW effects on care homes' outcomes, had significant independent impact on these outcomes. Our results suggest that higher increases in COVID-19 in the area care homes operate and higher share of EU employees at the care home, on average, led to a significant reduction in employees' absenteeism and to a significant increase in deaths due to COVID-19 at the care home.

1. Introduction

The introduction of the National Living Wage (NLW) on 1 April 2016 at £7.20 an hour for those aged 25 and above was a significant increase in the level of the minimum wage, equivalent to 10.8 per cent in nominal terms, compared to the previous year (LPC, 2020). Since then, annual increases in the NLW through to April 2020, recommended by the Low Pay Commission (LPC), the body making recommendations to the government about the level of minimum wage increases, delivered on the government's commitment of a NLW at a level equal to 60 per cent of median earnings by 2020.

Following this, the government has set a new ambitious target and provided the LPC with a new remit to recommend the pathway of NLW increases so that the NLW reaches two-thirds of median earnings for those 21 and over by 2024. As part of its new remit, the LPC recently recommended that the NLW increases to £8.91, an increase of 2.2 per cent, in April 2021 as well as that its coverage extends to include individuals below 25 years, but not younger than 23 years old, for whom the minimum wage is expected to increase by 8.65 per cent. Therefore, to inform the LPC on setting the future pathway of the NLW to achieve its new target, without damaging employment prospects, new evidence is needed on how the forthcoming increases will impact on low-wage workers and their employers.

Moreover, new high-quality studies evaluating the impact of increases in the NLW on low-wage sectors are vital, considering that the context of the most recent and the forthcoming increase in the NLW is dramatically different than previous increases. The current context is dominated by the continuing effects of the COVID-19 pandemic, which have led to an unprecedented recession in the UK economy, as well as the government's measures to mitigate it (LPC, 2020). Moreover, the latest increase in the NLW, in April 2021, occurred under a new trade relationship of the UK with the EU (Brexit), which became effective on 1 January 2021, which may disproportionately affect low-paying sectors.

Thus, impacts of the recent and forthcoming NLW increases and the mechanisms through which they operate may differ from those uncovered by previous studies producing evidence of a significant impact on hourly earnings, but no or limited adverse employment effects (LPC, 2020).

This report aims to investigate this through an in-depth analysis of the impacts of NLW on businesses in a specific low-paying sector, the adult social care (ASC) sector in England, in the context of the COVID-19 pandemic and Brexit.

The ASC sector has been, historically, significantly affected by changes in minimum wages, including the National Minimum Wage (NMW) (Machin et al., 2003) and more recently the NLW (Giupponi et al., 2017), as it employs a large share of low-wage workers. Moreover, increased costs arising from minimum wage increases put considerable pressure on care providers who rely heavily on government funding (CQC, 2020), which has been deemed as inadequate to cover the increased demand for services due to the ageing of the UK population and the increased costs of "later-life illnesses" (CQC, 2020).

A significant body of evidence, however, accumulated since the introduction of the NMW in 1999, including studies funded by the LPC, supports that, although the introductions of the NMW and the NLW and their subsequent increases heavily affected the wage structure in the social care sector, their adverse employment effects have been elusive (Machin et al., 2003;

Machin and Wilson 2004; Bessa et al., 2013; Gardiner, 2016; Giupponi et al., 2017; Giupponi and Machin, 2018; Vadean and Allan, 2020). Moreover, the evidence suggests that this could be explained by a variety of adjustments by care providers, including modest reductions in hours (Machin et al., 2003; Vadean and Allan, 2020); reduction in profits (Draca et al., 2012); improvements in productivity/efficiency (Georgiadis, 2006, 2013); deterioration of quality of care (Giupponi and Machin, 2018); and increased reliance on zero-hours contracts (Datta et al., 2019; Vadean and Allan, 2020).

It is uncertain, however, whether the impact of the latest two increases in the NLW – which coincided with the onset and continuing effects of the pandemic as well as the introduction of Brexit – on employees' and care homes' outcomes, as well as the mechanisms through which they operate are likely to be similar to those of previous periods, uncovered by existing studies.

This is because the COVID-19 pandemic had a dramatic effect on the social care sector through increasing the importance of its service due to the very high risk it posed to older people and the resulting high mortality rates among service users (CQC, 2020). The social care sector provided an essential service during the pandemic, and, thus, unlike other low-wage sectors, has not been forced to close and did not rely much on government employment protection measures, such as the Coronavirus Job Retention Scheme (CJRS). As a result of this and increased safety considerations, the pandemic increased demands for additional investments by care providers, but also for additional staff, to address the high risk of infection among employees, as well as demand for increased effort by employees (LPC, 2020; CQC, 2020). This is likely to limit standard channels of adjustment to minimum wage increases by care providers (LPC, 2020).

The same holds for Brexit which may exacerbate current difficulties related to the retention and recruitment of workforce, considering the reliance of the sector on employees from EU employees, particularly in some regions, such as London and the South-East of England, which has been systematically increasing over time (Dolton et al., 2018; Skills for Care, 2020).

Overall, both the COVID-19 pandemic and Brexit may influence the direction and magnitude of the impacts of NLW increases on employees and businesses in the social care sector, as well as the channels via which these impacts manifest. It has been argued that Brexit and COVID-19 are expected to exacerbate existing long-standing challenges affecting the sector going forwards, including budgetary pressures, staff shortages, and poor conditions for employees (LPC, 2020).

Therefore, the main objectives of this report are to identify the independent and synergistic impacts of NLW, COVID-19, and Brexit on a range of employees' and business outcomes in the sector. This aims to shed light to two aspects of the impacts of minimum wages that have received relatively less attention in the current literature: the first is the extent to which minimum wage effects are heterogeneous and depend on contextual factors (Dolton and Bondibene, 2021; Christl, Kopl-Turyna, and Kuscera, 2018); the second, is how interactions of minimum wages with other government policies impact on employees' and firms' outcomes.

The report is structured as follows: in Section 2, we discuss the data and present descriptive statistics of the variables used in our analysis; Section 3 presents the methodology employed to estimate effects of the NLW, COVID-19, and Brexit on care homes' outcomes; Section 4 presents and discusses estimation results of the effects of the three treatments of interest to our analysis on wages, employment, and other care homes' outcomes; and Section 5 concludes.

2. Data and Descriptive Statistics

The secondary data used in our analysis is the Adult Social Care Workforce Data Set (ASC-WDS) an online data collection service managed by Skills for Care, a charity and partner of the Department of Health and Social Care, and the leading source of workforce intelligence in the ASC sector in England (Skills for Care 2020). This data set has been used in previous studies evaluating impacts of the NMW and the NLW in the ASC sector (Gardiner, 2016; Giupponi and Machin, 2018; Vadean and Allan, 2020), including studies funded by the LPC (Bessa et al., 2013; Giupponi et al., 2017). The ASC-WDS has several unique features and advantages pertinent to the proposed investigation, and relative to other datasets that include information across sectors of the economy, such as the LFS, ASHE, and WERS (Bessa et al., 2013; Giupponi and Machin, 2018; Skills for Care, 2020) such as:

- *Large size:* the dataset covers approximately half of the ASC sector in England and includes information on 8,000 care-providing organisations, with around 25,000 establishments and 650,000 employees (Giupponi and Machin, 2018; Skills for Care, 2020).
- *Representativeness:* previous research has shown that the ASC-WDS is representative of the population of care homes and their employees along a range of characteristics (Giupponi and Machin, 2018).
- *Richness of information:* the dataset provides detailed and accurate information on individual wages for all employees within each home, as well as information on a range of individual-level and home-level characteristics and variables that may have a bearing on pay-setting decisions, such as employment and hours, turnover, hiring, vacancies, contractual arrangements (agency hiring and zero-hours contracts), training and qualifications, and days lost due to sickness (Bessa et al., 2013).
- *High quality information:* the quality and accuracy of ASC-WDS is high. The data are based on documented evidence, such as timesheets, information on payment from the tax and revenue departments, and contracts. Thus, it is at least as accurate as other workplace surveys data, such as the Workplace Employment Relations Survey (WERS).
- *High-frequency panel data:* information at home- and employee-level is reported at regular intervals during a given year (Gardiner, 2016), resulting in a matched employer-employee high-frequency panel data set. This allows measurement of home-level outcomes before and after the NLW increase and the use of the difference-in-differences approach, the dominant approach in the evaluation of the impacts of minimum wages in the literature (Card and Krueger, 1995; Machin et al., 2003), and of studies commissioned by the LPC (Giupponi et al., 2017); as well as other associated estimation methods suitable for panel data that address econometric problems related to the identification of causal effects.

Potential limitations of the ASC-WDS data sets include the lack of information on other important margins of adjustments, such as prices and profits. Price adjustments, however, may be limited, as prices for a significant share of service users are capped by local authorities (Machin et al., 2003). Other potential limitations include non-regular updating of information in some care homes or no verification of the accuracy of the information supplied by some providers (Gardiner, 2016). Our analysis carefully checks whether the first issue may be a concern for our investigation and addresses the second issue by excluding inaccurate observations from the analysis, as these are flagged by Skills for Care, as well as control for a range of (fixed and time-variant) factors to address potential sample selection bias. Moreover, skills for care (Skills for Care, 2020) reports no disruptions in data reporting by employers during the pandemic. For our analysis, we use quarterly data from ASC-WDS between December 2019 and June 2021.

We obtained information on COVID-19 deaths from two data sources: the first data set was compiled by the Office of National Statistics (ONS, 2021) and includes information on deaths registrations and occurrences at local authority level in the UK, by cause and place of death, e.g., deaths due to COVID-19 in care homes, hospitals, etc., and at weekly frequency; the second data set was compiled by the Care Quality Commission (CQC), the body regulating the ASC sector in England, and includes information on death notifications involving COVID-19 of care home residents in all care homes in England regulated by CQC at quarterly frequency between April 2020 and March 2021.[1] Information from both these sources was matched to the ASC-WDS localities and care homes in the corresponding periods.

Tables 1 and 2 present descriptive statistics of key employees' and care homes' characteristics respectively, in the resulting matched data set, in the period before and after the last increase in the NLW, between March (January-March quarter) and the June (April-June quarter) 2021, in the full sample and balanced panel (homes present in ASC-WDS in both periods) sample.

Statistics in Table 1 indicate that around 40 per cent of employees in care homes in the balanced panel in March 2021, on average, were paid below £8.91 per hour, that is the level of the NLW in April 2021 [(share) low-paid]; and that the average increase in the care home weekly wage bill, if the pay of all employees paid below the NLW in March 2021 was increased at the NLW level in the following period, (wage gap), was 1 per cent in the balanced panel. Table 1 also shows that the average age of employees is around 40 years; employees were predominantly female and white; around one in five employees was employed under a zero-hours contract; one in two employees holds a qualification relevant to social care; and that two out three employees received training by the current employer.

Moreover, Table 1 suggests that most employees had British nationality and that the share of EU employees in total employment is 7 per cent, which is slightly above the national average (Skills for Care, 2020). Figures 1 and 2 show the evolution of the share of EU, other non-British, and British employees in total care home employment. Figure 1 shows that since 2015 the share of EU employees has been increasing, even in the period after the result of the referendum on the UK's EU membership (June 2016), and that it has been relatively stable since 2018, but exhibiting a slightly decreasing pattern after December 2020, when the UK officially exited the EU and the new trade relationship between UK and EU has been enacted. The patterns are similar for the share of other non-British nationalities in the period since 2018, but the key difference is that, in contrast to the share of EU employees, the share of employees of non-EU and non-British nationality exhibited a steady decline prior to 2018. Furthermore, Figure 2 shows that in the period between 2015 and 2021 the share of employees with British nationality increased slightly.

Table 2 indicates that the average home was relatively small, with around 40 employees; the data include, on average, individual employee information on 90 per cent of employees at the care home; around one in two workers were care workers (care assistants and senior carers), the occupation engaging in the direct care of service users; almost all homes were part of a larger organisation; and 70 per cent of care homes in the data were regulated by the CQC. Table

[1] Missing information on deaths due to COVID-19 at the care home level, e.g., for homes not regulated by the CQC or for periods when CQC data were not available was imputed either using information on deaths at the local authority level, e.g., deaths for all homes in a given locality were coded to 0 if total deaths in the locality or total deaths in care homes in the locality were equal to 0; or using the average number of deaths at the care home, calculated by dividing total deaths due to COVID-19 in care homes with the number of care homes in the locality.

2 also shows that in the quarter between January and March 2021, based on the data by ONS, there were on average 213 deaths due to COVID-19 at the local authority level and that this declined dramatically to around 9 deaths in the following quarter. The same pattern seems to be the case for the average number of deaths at the care home level, based on CQC data. In addition to Table 2, Figure 3 shows the evolution of the average number of deaths due to COVID-19 at the local authority level (all deaths and deaths in care homes), and Figure 4 shows the evolution of the average number of deaths due to COVID-19 at the care home level. These patterns are in line with the UK government data documenting that the impact of COVID-19 in the UK has peaked in April 2020 and January 2021 (https://coronavirus.data.gov.uk/details/deaths).

Overall, descriptive statistics on employees and firms' characteristics in the adult social sector presented here are in line with previous studies (Machin et al., 2003; Giupponi et al., 2017).

3. Methodology

Our approach to estimating independent and synergistic impacts of the NLW, COVID-19, and Brexit on key outcomes at the care home level between December 2019 and June 2021 is based on difference-in-differences (DID) estimation implemented through estimating the following equation:

$$\Delta y_{ist} = \beta_0 + \beta_1 T^{MW} * MW_{ist-1} + \beta_2 \Delta DC19_{st} + \beta_3 T^{BREX} * SH^{EU}_{ist-1} + \beta_4 T^{MW} * MW_{ist-1} * \Delta DC19_{st} + \beta_5 T^{MW} * MW_{ist-1} * T^{BREX} * SH^{EU}_{ist-1} + \beta_6 \Delta DC19_{st} * T^{BREX} * SH^{EU}_{ist-1} + \beta_7 T^{MW} * MW_{ist-1} * \Delta DC19_{st} * T^{BREX} * SH^{EU}_{ist-1} + \beta_8 SH^{EU}_{ist-1} + \beta_9 T^{MW} * MW_{ist-1} * SH^{EU}_{ist-1} + \beta_{10} \Delta DC19_{st} * SH^{EU}_{ist-1} + \beta_{11} T^{MW} * MW_{ist-1} * \Delta DC19_{st} * SH^{EU}_{ist-1} + \boldsymbol{\beta'_{12} X_{ist-1}} + \alpha_i + \alpha_t + u_{ist} \quad (1)$$

where, Δy_{ist} is the change in the outcome of home i, operating in locality s, between periods $t-1$ and t; $\boldsymbol{X_{ist-1}}$ is a vector of time-variant controls measured at the initial period; α_i is a home-specific individual effect; α_t stands for a period effect; and u_{ist} is an error term.

Detailed definitions of all variables in (1), included in our estimated specifications, are provided in Table A1 in the Appendix.

The measure of the intensity of the NLW "treatment" is expressed by the term $T^{MW} * MW_{ist-1}$, where T^{MW} is a dummy variable taking the value 1 if the observation is from a period when the minimum wage is increased, i.e., April 2020 and April 2021, and is zero otherwise; and MW_{ist-1} stands for a measure of the 'bite' of the minimum wage in home i in period $t-1$, just before the minimum wage is increased – we used two alternative measures, the share low-paid and the wage gap, discussed in the previous section, which were also employed by previous studies (Machin et al., 2003; Giupponi et al., 2017). NLW increases are expected to impact care homes outcomes through putting pressure on the care home's wage bill.

The measure of the intensity of the COVID-19 "treatment" is expressed by $\Delta DC19_{st}$, which is the change in the log of number of deaths due to COVID-19 in the locality between t-1 and t. The hypothesized mechanism through COVID-19 impacts care home outcomes is through increased demand for inputs, including capital/equipment and employees' effort, necessary for delivering care and protect residents from potential risk of COVID-19 infection. Equation (1) assumes that care home outcomes respond contemporaneously to changes in log COVID-19 deaths in the locality. One advantage of using the change in log deaths due to COVID-19 in

the locality as the COVID-19 "treatment" measure is that it measures the proportional change in deaths due to COVID-19 in the locality over time, and thus, it is not expected to pick up differences across areas, such as size and population density for two reasons: first, because first-differencing is expected to eliminate fixed area characteristics, and second, because it adjusts changes in number of deaths due to COVID-19 with the number of deaths due to COVID-19 in the initial period.[2]

The measure of the intensity of the Brexit "treatment" is expressed by the term $T^{BREX} * SH^{EU}_{ist-1}$, where T^{BREX} is a dummy variable taking the value 1 if the observation is from a period when Brexit is enacted, i.e., January to June 2021, and is zero otherwise; and SH^{EU}_{ist-1} is the share of EU employees in total employment of care home i at t-1. This aims to capture the extent that the care home's local labour market supply is expected to be affected by changes in immigration rules for EU employees resulting from Brexit. One hypothesised channel through Brexit may impact care homes' outcomes is through higher labour supply restrictions among care homes operating in labour markets with higher share of EU employees in total labour supply.

A potential limitation of the measure of Brexit "treatment" is that it is measured at the firm level, and thus it is potentially endogenous, as it is partly under the control of the firm. Despite this, the firm-level measure was preferred to alternative measures, observed at the locality level for two reasons: first, because it may better reflect the share of EU employees in the home's local labour market supply than measures observed at the local authority level, considering the evidence that labour markets are more local than suggested by administrative boundaries (Manning and Petrongolo, 2017); and second, because locality-level measures are expected to be strongly correlated with the measure of COVID-19, also measured at the local authority, and thus, equation (1) could not identify the effect of Brexit on the outcome manifesting through changes in COVID-19 impact in the locality.

Equation (1) also includes all interactions of the three treatment intensity measures. This aims to examine whether the effect of each treatment is heterogeneous and depends on the level of the other treatments, i.e., that the effect of each given treatment on care homes' outcomes may be mitigated or magnified by the other treatments: for example, the magnitude of the NLW effect of care homes' wage growth may vary with the evolution of COVID-19 pressure in the locality care homes operate and the "bite" of restrictions associated with Brexit at the care home.

Equation (1) is estimated using a fixed effects panel data estimator that accounts for home-specific fixed effects in outcome trends, which relaxes the identifying assumption of DID estimation that there are parallel trends between treatment and control groups, in the absence of the treatment (Angrist and Pischke, 2009). This is because we find evidence of non-parallel trends in hourly wages across homes expected to be differentially affected by the NLW, before and after April 2015, when the NLW was not in place (see Table A2 in Appendix for details).

[2] The change in log deaths due to COVID-19 in the locality s between periods $t-1$ and t can be expressed as follows: $\Delta logCOVID19deaths_{st} = logCOVID19deaths_{st} - logCOVID19deaths_{t-1} \approx \frac{COVID19deaths_t - COVID19deaths_{t-1}}{COVID19deaths_{t-1}} = \frac{\Delta COVID19deaths_t}{COVID19deaths_{t-1}}$.

The same was not the case, however, in the case of hourly wages trends across firms with different shares of EU employees in the same period (see Table A1). Identification of the independent and synergistic causal effects through estimation of equation (1) via fixed effects rests on the assumption, typical in differential trends adjusted DID estimation (Blundell and Costa Dias, 2009), that differences in trends across homes differentially affected by each or combinations of the three treatments considered here, are fixed over time;[3] or that, in case they are not, these differences are adequately controlled by the inclusion of time-variant controls in equation (1). In the case of the NLW, the fixed effects estimator identifies the NLW effects using within care home variation in the 'bite' of the NLW over two periods with different increases in the NLW, i.e., April 2020 (6.2%) and April 2021 (2.2%). In this way, minimum wage 'bite' measures are not expected to pick up variation in unobserved factors, which are either fixed or change slowly over time, associated with the level of initial wages at the care home, e.g., bad management.

In the case of the independent and synergistic effects of Brexit, time-variant differential trends, in the absence of Brexit, are controlled for by including in (1) the share of EU employees, SH_{ist-1}^{EU} and all its interactions with the other two treatments, in periods prior to the introduction of Brexit.[4]

Another key concern in estimation of treatment effects via DID arises from anticipation effects of the treatment. We have tested this in the case of the NLW via estimating an extended version of equation (1) that includes minimum wage 'bite' measures observed contemporaneously with the outcome, i.e., period t (see Table A3 in the Appendix for details). This considers that, in the two minimum wage increases during the period we consider, forthcoming minimum wage rates were announced in January and thus any anticipation effects may be present in the quarter just before minimum wages are uprated. We find no evidence of significant anticipation effects of the NLW on hourly wage growth (evidence on anticipation effects of Brexit are discussed in one of the following sections).

A final concern related to the estimation of the effects of the three treatments via estimation of equation (1) is that, even though the timings of the three treatments were independent, their 'intensities' may be correlated. It may be that higher 'bites' of the NLW and Brexit at a given care home influence the change in deaths due to COVID-19 in the area, via, for example, impacting deaths due to COVID-19 at this care home. We address this concern by excluding the changes in deaths due to COVID-19 at the individual care home from the measure of the impact of COVID-19 in the area, used in (1). Nevertheless, it is still possible that higher 'bites' of the NLW and Brexit at a given care home affect change in deaths due to COVID-19 in the area through spill-over effects on other care homes or even in other settings, such as hospitals. We find evidence supporting this hypothesis (see Table A4 in the Appendix for details). We find that higher minimum wage 'bite' at the individual care home is associated with higher percentage increases in deaths due to COVID-19 in the area the care home operates; and higher share of EU employees at the care home is associated with increases in COVID-19 deaths in the area in periods when Brexit was effective, but with decreases in deaths due to COVID-19 in the area in periods prior to Brexit. The latter evidence may support the validity of the share of EU employees at the home as a measure of the impact of Brexit, as it suggests a shift of the

[3] This assumption could be indirectly tested by implementing a fixed effects in trends estimator using data in periods when the NLW was not in place, i.e., prior to 2016. Nevertheless, this requires data from four points in time, i.e., two periods with information before and after a "placebo" increase in the minimum wage in each period, which are not available in our case.

[4] These are the terms in (1) including SH_{ist-1}^{EU} not interacted with T^{BREX}.

relationship between the share of EU employees at the firm and COVID-19 deaths in the area between periods before and after Brexit become effective; and it may also provide support to our choice to control for the share of EU employees in periods prior to Brexit in all estimated specifications.

The evidence that the NLW 'bite' at the home level impacts on changes in COVID-19 deaths in the area imply that specification (1) is going to identify effects of the NLW on the outcome operating over and above any effect of the NLW on the outcome manifesting via changes in COVID-19 deaths in the area (we call these "direct effects"). These effects, however, will differ from the total effects of the minimum wage on the outcome only in the case when the minimum wage and the change in COVID-19 deaths in the area have a significant effect on the outcome. In the latter case, we also present estimation results from a version of (1) that excludes change in COVID-19 deaths in the area, which are expected to express total effects of NLW. The same logic applies for the relationship between Brexit, the change in COVID-19 deaths in the area, and the outcome, and thus, we follow the same approach in estimating direct and total effects of Brexit on outcomes of interest.

We do not expect, however, that the effect of the NLW on a given outcome is mediated by the share of EU employees at the firm. This is because, a significant effect of the NLW on the share of EU employees measured in the same period, would require anticipation effects of the NLW wages on home wages, which are not the case as suggested by the evidence here.[5] Similarly, the fact that we do not find any evidence of anticipation effects of the share of EU employees at the home on home wage growth (see Results section for a discussion) implies that it is unlikely that the effect of the share of EU employees on any outcome is mediated via NLW 'bite' measures in the same period.[6]

4. Results

Impacts on Care Home Wages

We first look at the effects of the three treatments on care home wages, partly because these effects are a pre-requisite for looking at effects of the NLW on other outcomes. Figures 5 and 6 present the hourly wage distribution of care workers (assistants), the principal and lowest-paid occupation in the sector, from the balanced panel of care homes, before (quarter January to March) and after (quarter April to June) the 2021 NLW increase. Figure 5 shows a spike at £8.72, the level of the NLW between April 2020 and March 2021, with 20 per cent of care assistants paid exactly the NLW, and around 40 per cent of care assistants, in the first quarter of 2021, paid below £8.91, the level at which the NLW was increased at in April 2021. Figure 6 indicates significant changes in the hourly wage distribution of care assistants: in the three months following the April 2021 increase in the NLW, both the spike in the distribution shifted from the old to the new level of the NLW and the share of care assistants paid below £8.91 decreased to around 20 per cent.[7] This evidence shows that the NLW increase has heavily impacted the wages of the lowest-paid occupations in the ASC sector.

[5] This is because effects of minimum wage impact measures in period $t-1$ on the share of EU employees in the same period should necessarily operate via its effects on wages in this period.
[6] This is because the EU share may affect minimum wage bite measures via affecting the level of initial wages at the home, i.e., wages in period $t-1$.
[7] This includes employees below 23 years old not covered by the NLW.

Table 3 presents estimation results of equation (1) with the outcome measure being the care home average hourly wage growth. The upper panel of Table 3 presents estimates of the coefficients of the levels and interactions of the three treatment intensity measures. Due to the inclusion of interactions, coefficient estimates of treatment intensity measures do not express the marginal effects of these treatments. In some cases, however, coefficients may express marginal effects of a given treatment evaluated at specific values of the other two treatments. For example, estimates of coefficients of the share low-paid or wage gap in Table 3 express marginal effects of the NLW on home's hourly wage growth, among homes a) with no EU employees,[8] b) operating in areas where the change in COVID-19 deaths was equal to the median of distribution of the change in COVID-19 area deaths.[9]

The bottom panel of Table 3 shows significant and positive marginal effects of minimum wages on wage growth, evaluated at sample means. Estimates of marginal effects suggest a negative effect of COVID-19 on hourly wage growth, which is significant in some specifications, but no significant marginal effect of the share of EU employees on care homes' hourly wage growth. As discussed in the previous section, because marginal effects of the NLW and COVID-19 in specification (2) are significant, we also estimate a specification that excludes the measure of COVID-19, and its interactions, which allows us to estimate the total effect of NLW hourly wage growth, including effects of NLW on wage growth mediated by changes in COVID-19 deaths in the locality. Results of this estimation are presented in specification (3) of Table 3. Comparisons of results between specifications (2) and (3) show no significant differences between direct and total effects of the NLW on care homes' hourly wage growth. This could be explained by the fact that the coefficient of the COVID-19 measure in specification (2) is weakly significant.

Estimation results from the upper panel of Table 2 show negative and significant estimated coefficients of the interaction of NLW and COVID-19 measures across specifications. This implies that the marginal effect of the NLW on carehomes' hourly wage growth is heterogeneous, i.e., that hourly wage growth induced by NLW increases was smaller among firms operating in areas with higher increases in deaths due to COVID-19. This heterogeneity of marginal effects of minimum wages is illustrated in Figure 7, with the linear relationship between hourly wage growth and the wage gap being steeper among care homes in areas where the change in COVID-19 deaths was at the 25th percentile of the distribution of change in COVID-19 deaths compared to firms in areas where the change in COVID-19 deaths was at the 75th percentile. Plotted 95% confidence intervals in Figure 7 suggest that individual marginal effects are significantly different from zero and the same holds for their difference, both at the 5% level.

Estimation results of the effects of the three treatments on weekly earnings, presented in Table 4, show positive and significant marginal effects of the NLW on carehomes' average weekly earnings growth. These effects are slightly smaller in magnitude than the NLW effects on hourly wage growth.[10] Moreover, estimates in Table 4 show no significant effects of COVID-19 or Brexit measures on weekly earnings growth. Like our results for hourly wage growth, we

[8] Around half of care homes in the sample for the period considered have no EU employees.
[9] This is because change in deaths due to COVID-19 in the area were expressed as deviation from the median of the distribution.
[10] This is particularly the case in specifications where the measure of the 'bite' of the NLW is the wage gap.

find evidence that weekly earnings growth, associated with NLW increases, was smaller in magnitude among firms operating in areas with higher increases in deaths due to COVID-19.[11]

We find no evidence that NLW marginal effects on hourly or weekly wage growth are significantly moderated by the share of EU employees at the firm.

In sum, we find that, on average, NLW increases had a significant effect on care homes' growth of hourly wages and weekly earnings. The magnitude of these effects, however, appear small relative to previous NLW increases, possibly due the relatively smaller 'bite' of the NLW in April 2020 and 2021(Giupponi et al., 2017). Estimates of marginal effects of the NLW in Tables 3 and 4 suggest that care homes with 10 percentage points higher wage gap experienced around 2 per cent higher hourly wage growth and 1 per cent higher weekly wage growth.

We also find evidence that effects of the NLW on care homes' wage growth are heterogeneous and are statistically significantly smaller among care homes in areas more heavily hit by COVID-19. Mitigation effects, however, appear small: among homes with the same 'bite' of the NLW, care homes in areas with 10 per cent higher increase in COVID-19 deaths than then mean, experienced 0.02 per cent lower hourly wage growth and 0.03 per cent lower weekly earnings growth. This could be explained by the fact that care homes in areas more heavily hit by COVID-19 had more stringent budgets due to additional spending on protection measures.

Impacts on Care Home Employment and Hours

Estimates of impacts of the three treatments on home employment growth, as measured by the change in the log number of employees are presented in Table 5. Coefficient estimates, of levels and interactions, of the treatment measures, and marginal effects of the treatments are insignificant across specifications, after controlling for covariates. We find, however, evidence that marginal effects of NLW on employment growth are negative, and increasing, in absolute value with the change in COVID-19 deaths in the area and that they turn significant for sufficiently high values of the change in COVID-19 deaths in the area. Figure 8 illustrates this pattern.

As discussed in the previous section, care homes in areas more heavily hit by COVID-19 experienced relatively smaller hourly and weekly wage growth because of the NLW. This suggests a pattern consistent with higher relative employment growth among homes in which the NLW led to higher relative wage growth, which, in turn, implies adjustments along a labour supply curve rather than a labour demand curve. The latter seems to be consistent with predictions of models of imperfect labour markets (monopsony) rather than the standard competitive model (Manning, 2003).

Tables 6 and 7 present estimation results of different specifications of equation (1) with total weekly hours at the home and full-time equivalent (FTE) employment as dependent variables.[12] Results suggest no significant coefficient estimates and marginal effects of the three treatments, after controlling for covariates.

[11] The difference between marginal effects of NLW on weekly wage growth at the 25th and 75th percentile of the COVID-19 intensity measure is significant at 5% level. Individual marginal effects of NLW on weekly earnings growth turn insignificant, as suggested by Bonferroni-adjusted p-values, at sufficiently high values of the COVID-19 measure, e.g., above the 75th percentile of the distribution of the change in COVID-19 deaths.

[12] FTE employment is calculated as the weighted number of employees at the home using as weights for each employee their share of full-time employment based on their total weekly hours.

Overall, we find evidence that the NLW had no significant effects on care homes' employment and hours, even though it had significant positive effects on wage growth. We also find some evidence that the employment effects of NLW are heterogeneous and vary with the impact of COVID-19, that is, care homes in areas more heavily hit by COVID-19 are more likely to experience employment losses because of NLW increases. We argue that this is consistent with monopsony considerations in the ASC labour market, which may explain why the NLW had no employment effects, although it led to significant wage increases in the sector. Finally, we find no significant effects of COVID-19 and Brexit on employment and hours in the ASC sector.

Impacts on Care Home HRM Outcomes

We investigated impacts of the three treatments on a range of home outcomes related to Human Resources Management (HRM), such as outcomes related to employees' retention, recruitment, motivation, training, and contractual arrangements.

Tables 8, 9, 10, and 11 present estimation results of effects on the home annual staff turnover rate, recruitment rate, vacancy rate, and absenteeism due to sickness. This analysis is motivated by two considerations: a) first, studies in the minimum wage literature and previous studies suggesting that the minimum wage may operate as an efficiency wage (Card and Krueger, 1995; Georgiadis, 2013); and b) second, expectations that the COVID-19 pandemic and Brexit may have significant implications in terms of staff recruitment and retention outcomes and may lead to staff shortages (Skills for Care, 2020).

Tables 8 and 9 show no significant marginal effects of either treatment on employees' turnover or recruitment.[13] Table 10 presents estimation results of impacts on the change in home's annual vacancy rate. Estimates of marginal effects suggest that, on average, only the share of EU employees at the home had a significant effect on the change in the vacancy rate at the home. This is consistent with the hypothesis that homes relying more heavily on EU employees are more likely to experience recruitment difficulties and may further suggest that the share of EU employees at the home is a valid measure of the impact of Brexit on care homes' outcomes. There is some indication that marginal effects of NLW on carehomes' vacancy rates are heterogeneous and moderated by COVID-19 and Brexit, that is, marginal effects are positive and larger in magnitude among firms in areas with higher increases in COVID-19-related deaths and higher shares of EU employees. These differences, however, are weakly significant.

Table 11 shows that all three treatments considered have, on average, a negative and significant marginal effect on the percentage change of annual total employees' days lost due to sickness.[14] Moreover, in general, comparisons of results in specifications (2) and (3) and specifications (5) and (6) suggest that direct effects and total effects of the NLW and the share of EU employees are very similar.

[13] Coefficient estimates of specifications (2) in Tables 8 and 9, however, suggest that the minimum wage increase may have resulted in decreased staff turnover and recruitment among firms with no EU employees and change in COVID-19 deaths in the area equal to the median of the distribution of the change in COVID-19 deaths in the area.

[14] As Table 11 shows, for the NLW this is the case only in specifications including the share low-paid at the home as a measure of the bite of the NLW.

In terms of the heterogeneity of marginal total effects of the NLW, the most systematic result, as shown in specifications (3) and (6) of Table 11, is that the lagged one period share of EU employees mitigates the effect of the NLW on the change of days lost due to sickness. This has different implications depending on the NLW 'bite' measure used in estimation. Figure 9a shows that, in specifications with the share low paid as the NLW 'bite' measure, the effectiveness of the NLW to reduce absenteeism is decreasing with the share of EU employees in home's total employment; whereas Figure 9b suggests that NLW may even lead to a significant increase in employees' absenteeism in homes with sufficiently high share of EU employees in total employment.

Table 12 presents coefficient estimates and marginal effects of the three treatments on the change in the share of staff provided training by the current employer. Estimates of marginal effects suggest that NLW increases, and Brexit led to a reduction in share of staff provided training, but these results are not systematically significant across specifications. Figures 10a and 10b show that the direction and magnitude of the marginal effect of the NLW on the share of staff provided training differ systematically with the magnitude of the increase in COVID-19-related deaths in the area and the share of EU employees in homes total employment. Figure 10a shows that NLW increases may increase in the share of staff in the home who were provided training in homes with a lower share of EU employees operating in areas in which COVID-19 deaths exhibited high increases; whereas Figure 10b indicates that homes with higher share of EU employees in areas in which COVID-19 deaths decrease, the NLW is more likely to lead to a significant reduction in share of staff provided training.[15]

Results from the estimation of specifications with dependent variable the change in the share of employees in zero-hours contracts at the home, as shown in Table 13, suggest no significant marginal effects of any of three treatments, on average; as well as no significant estimates of the coefficients of the levels and interactions of the three treatments, after controlling for covariates.

In sum, we find some evidence that the NLW decreased absenteeism and training in the ASC sector. These effects, however, are small: based on estimates in the lower panel of specification (3) of Table 11, cares homes with 10 percentage points higher share of low-paid employees experienced, on average, 0.4% lower growth in total days of employees' work lost due to sickness per annum; and based on estimates in the lower panel of specification (4) of Table 12, care homes with 10 percentage points higher wage gap experienced a 0.8% reduction in the share of employees who were provided training by these care homes.

We also find that the sign and magnitude of the NLW effects on employees' absenteeism and training provision depend on the share of EU employees at the home, as well as the impact of COVID-19 in the area. In general, a higher share of EU employees at the home is associated with lower NLW effects on absenteeism, suggesting that Brexit abates improvements in staff motivation related to NLW-induced wage increases. Moreover, care homes with lower shares of EU employees in total employment operating in areas where COVID-19 was endemic were more likely to increase training in response to NLW increases. A potential explanation of this is that there were higher returns to training in these firms, given that these care homes face a higher COVID-19 emergency and lower restrictions related to recruitment and retention of staff arising from Brexit regulation.

[15] Differences in marginal effects of the two groups of homes in Figures 10a and 10b are significant at 1%.

Our results suggest that, on average, care homes in areas more heavily hit by COVID-19 and with higher share of EU employees in total employment experienced significant decreases in staff absenteeism and training provision.

Impacts on Care Home Deaths due COVID-19

Table 14 presents estimation results on the impact of the three treatments on the growth of deaths of residents due to COVID-19 at the care home. Estimated marginal effects suggest that, on average, care homes exposed to higher levels of each of the three treatments have seen significantly higher growth of deaths due to COVID-19. In the case of NLW and Brexit, comparisons of specifications (2) and (3) and (5) and (6) suggest that *total* (marginal) effects are systematically smaller in magnitude than *direct* (marginal) effects. This implies that *indirect* effects of these two treatments operating via the change in COVID-19 deaths in the area go in the opposite direction to *direct* effects.

Again, we find evidence suggesting that *direc*t marginal effects of the NLW on COVID-19 deaths at the home depend on the change in COVID-19 deaths in the area and the share of EU employees at the care home. Figure 11 shows that NLW may lead to significant decreases in COVID-19 deaths among care homes with sufficiently high share of EU employees in total employment operating in areas with sufficiently large decreases in COVID-19 deaths in the area; whereas the opposite effect is the case in care homes with low shares of EU employees in areas with large increases in COVID-19 deaths.

Similarly, as shown in Figure 12, the *total* marginal effect of NLW on COVID-19 deaths at the care home is likely to be positive and significant in care homes with a sufficiently high share of EU employees in total employment; and negative and significant in homes with low share of EU employees. This is consistent with significant estimated coefficients of interactions of NLW measures and the share of EU employees in specifications (3) and (6) in Table 14 suggesting that the share of EU employees significantly moderates the total effect of NLW on growth of COVID-19 deaths at the home.

Overall, we find some evidence that, on average, the NLW led to higher growth in deaths due to COVID-19 at the care home. These effects appear quite large: based on specification (6) in the lower panel of Table 14, care homes with 10 percentage points higher wage gap experienced, on average, 4.6% higher growth in deaths due to COVID-19.

Nevertheless, our results suggest that the sign and magnitude of NLW effects on deaths due to COVID-19 at the care home depend heavily on the extent of COVID-19 in the area and the share of EU employees at the home: NLW is more likely to lead to higher growth in deaths due to COVID-19, in care homes with higher share of EU employees in total employment operating in areas more heavily affected by COVID-19.

We also find, that, on average, COVID-19 in the area and Brexit significantly impact on COVID-19 deaths at the care home. Effects of COVID-19 in the area are small: estimates in specifications (2) and (4) in the lower panel of Table 14 suggest that 1% increase in COVID-19 deaths in the area leads to around 0.07% increase in COVID-19 deaths at the care home; whereas effects of Brexit appear moderate: estimates in specification (3) in the lower panel of Table 14 suggest that in care homes with 10 percent higher share of EU employees in total employment there was around 1.8% percent higher growth in deaths due to COVID-19. Our

results also suggest that effects of Brexit on COVID-19 deaths at the care home are significantly mitigated by the NLW.

Summary of Main Findings and Robustness of Results

Our key findings could be summarised as follows:

First, we find that, on average, NLW increases had a significant positive effect on care homes' wage growth, but no significant effect on employment and hours. There are three potential explanations of these findings: the first is that NLW effects on wage growth are small, as the NLW increases considered here were small relative to previous periods; the second, is that there were other adjustments to the NLW that offset the resulting increase in wage costs: there is some evidence of decreases in employees' absenteeism and training, as well as increases in deaths due to COVID-19 at the care home, suggesting a deterioration of quality of care. One could speculate that the latter effect could result from lower absenteeism and training, which includes training on aspects such as health and safety, that could have led to higher COVID-19 contagion at the care home. The third explanation is related to imperfect competition/monopsony considerations in the ASC labour market supported by evidence that employment growth was the lowest among care homes seen the lowest wage growth because of NLW, which is suggestive of labour supply responses to the NLW (Manning, 2016).

The latter pattern relates to our second key finding that there is significant heterogeneity in the effects of NLW on care homes' outcomes. This is supported by evidence that NLW effects are significantly moderated by COVID-19 and Brexit. We find that care homes in areas with higher increases in deaths due to COVID-19, wage growth and reductions in training, triggered by the NLW, were smaller in magnitude, whereas growth in deaths due to COVID-19 at the care home, linked to the NLW, was larger. Moreover, our results suggest that in homes with higher share of EU employees in total employment, there were smaller reductions in employees' absenteeism, larger reductions in staff training, and smaller increases in deaths due to COVID-19 at the care home.

Our third key result is that we also find evidence that COVID-19 and Brexit, apart from moderating NLW effects on care homes' outcomes, had significant independent impact on these outcomes. Our results suggest that higher increases in COVID-19 in the area care homes operate and higher share of EU employees at the care home, on average, lead to a significant reduction in employees' absenteeism and to a significant increase in deaths due to COVID-19 at the care home.

A potential explanation of these effects could be due to COVID-19 and Brexit lead to higher demand for investment by management across different areas of operation (e.g., capital equipment, recruitment, etc.) and effort by employees at the care home and generate higher pressures on quality of care.

Related to the robustness of our results, we find evidence supporting the validity of the share of EU employees in care home's total employment in periods when Brexit is effective as a measure of the impact of Brexit on care homes' outcomes. We find evidence that, compared to periods prior to Brexit, the relationship between the share of EU employees at the home and care homes' outcomes has shifted significantly in the periods after Brexit was enacted (see for example Table A4 in the Appendix). Moreover, we tested for anticipation effects of Brexit following a similar approach to that for NLW: we estimated the relationship between the share

of EU employees in December 2020, just before Brexit was enacted, and changes in vacancy rate and total days lost due to sickness between March and June 2020 (see Table A5 for details).[16] Results support no anticipation effects of Brexit.

We also consider whether our results could be due to chance, given that our analysis involves estimation of effects of multiple treatments and their interactions on a range of outcomes. After adjusting for multiple-hypotheses testing using Bonferroni-adjusted p-values, our most strongly significant coefficient estimates, i.e., those in specifications for wage growth, days lost due to sickness, and deaths due to COVID-19 at the care home, remain significant.[17] Thus, our key conclusions on effects of these treatments on these outcomes as well as their lack of effect on other outcomes remain, after adjusting for multiple-hypotheses testing. Bonferroni adjustments, however, may be misleading, as they are too conservative (Young, 2019). Therefore, an alternative approach to identifying the most systematic results in our analysis is to consider those results which remain significant across specifications using different measures of the same dependent variable – for example, hourly and weekly wage growth as measures of wages and number of employees, total weekly hours, and FTE-employment as measures of employment – different measures of the 'bite' of the NLW, and after adjusting for a range of covariates. Again, our key conclusions are robust to the latter approach.

5. Conclusions

The aim of this report is to assess independent and synergistic impacts of NLW increases, the COVID-19 pandemic, and Brexit in the ASC in England. In line with previous studies of the impact of the NLW in the sector, we find that NLW increases between 2020 and 2021 led to significantly higher wage growth among care homes with relatively lower initial wages but had no significant effects on employment. We argue that these effects could be explained by other offsets to the NLW, such as reduction in employees' absenteeism and training, and deterioration of quality of care; as well as by additional evidence supporting imperfect competition/monopsony considerations in the ASC labour market.

A key novel finding of our analysis is that estimated NLW effects are heterogeneous, as we find that their sign and size of depend on the impact of COVID-19 pandemic in the locality care homes operate and the extent to which care homes are affected by new immigration rules for EU workforce resulting from Brexit.

Another new finding of our study is that COVID-19 and Brexit have significant effects on care homes' outcomes, and they lead to significant decrease employees' absenteeism and increases in deaths due to COVID-19 at the care home.

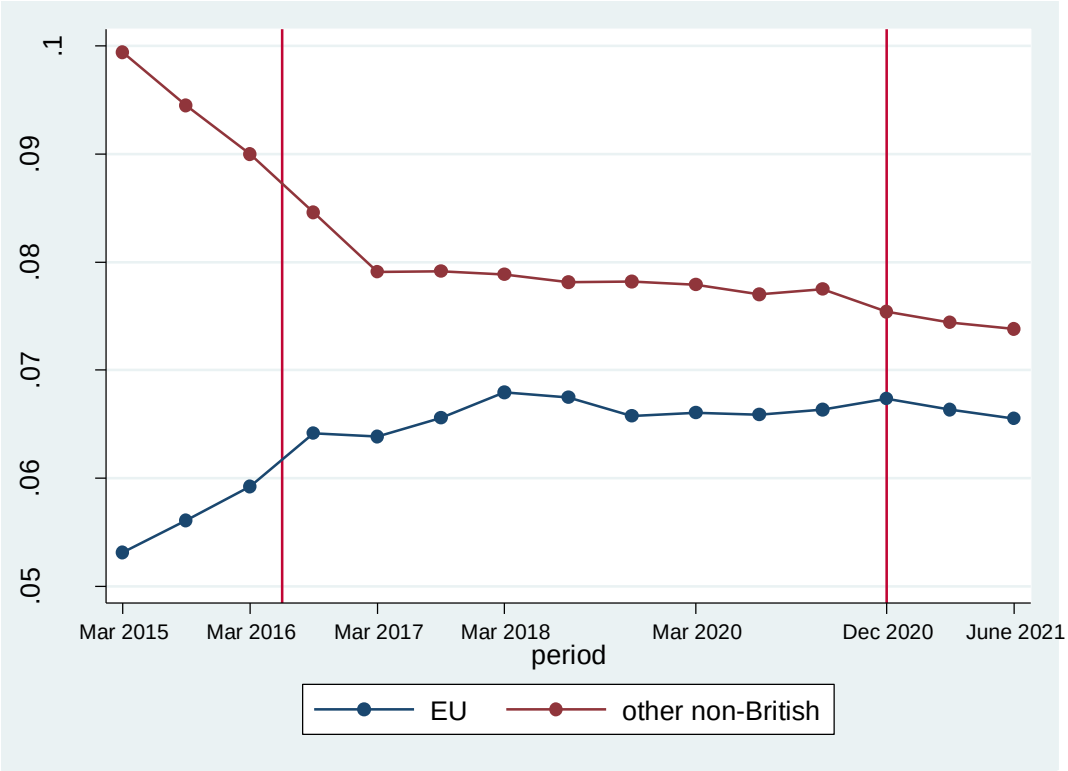
Although, there is some evidence that Brexit may be associated with increasing vacancy rates, we do not find systematic effects of Brexit across retention and recruitment outcomes, or significant wage and employment effects, suggesting significant labour shortages because of Brexit in the sector. This does not imply that these problems may not be present, but it may be explained by the fact that our analysis covers only the first 6 months after Brexit was

[16] This is first because these are two of the outcomes on which we found significant effects of the lagged one-period share of EU employees, and second because in this period, both NLW and COVID-19 are effective.
[17] This is because our most strongly significant coefficients are significant at around 0% and Bonferroni adjustments involve dividing p-values with the number of hypotheses tests (Young, 2019), which is 84 in our case, calculated by multiplying our 7 independent variables of interest with the 12 outcomes examined.

introduced. Follow-up studies should evaluate Brexit effects in the ASC labour market in the longer run.

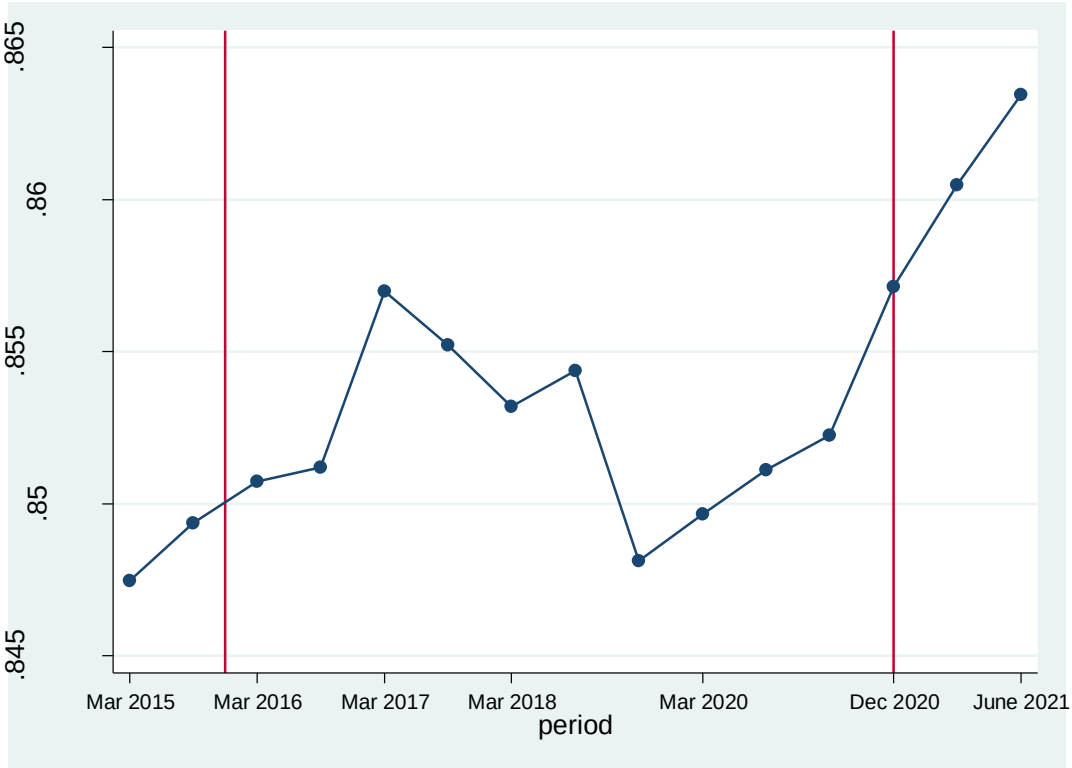
Finally, we also find evidence that higher 'bite' of NLW increases and exposure to Brexit at the care home led to higher deaths due to COVID-19 in the area, which imply spill-over effects of NLW and Brexit to other care homes and settings. Future research should investigate the mechanism underlying these spill-overs.

Figure 1: Shares of workforce with EU or other non-British nationality, March 2015-June 2021



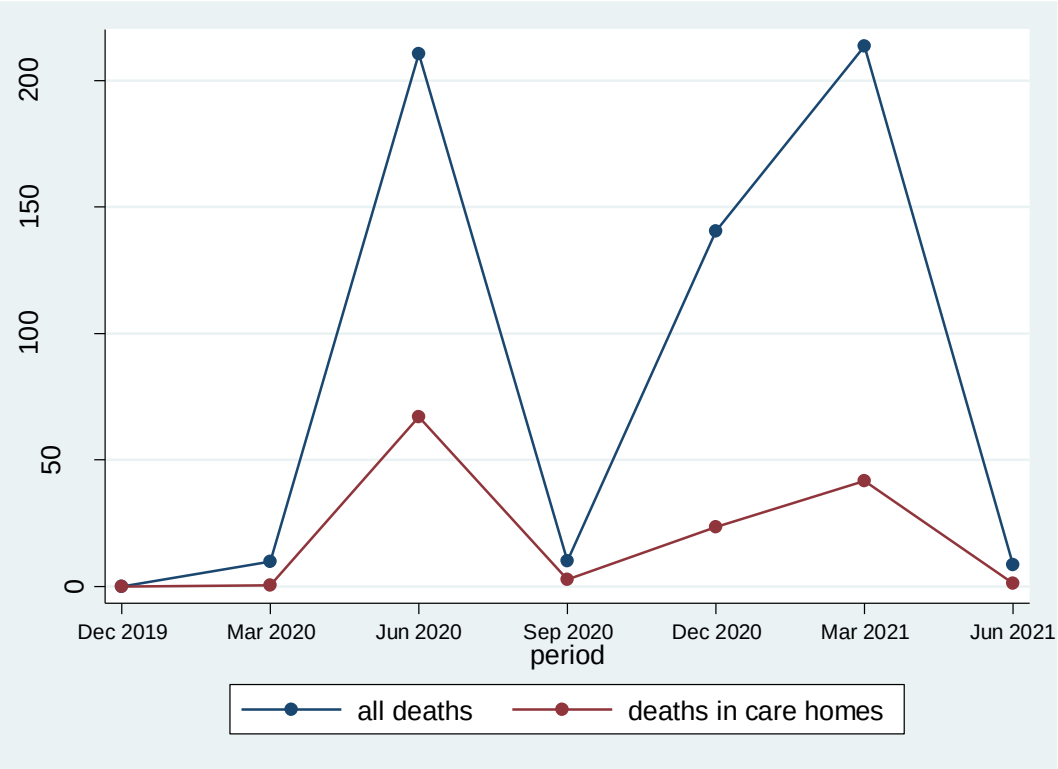
Notes: source ASC-WDS.

Figure 2: Shares of workforce with British nationality, March 2015-June 2021



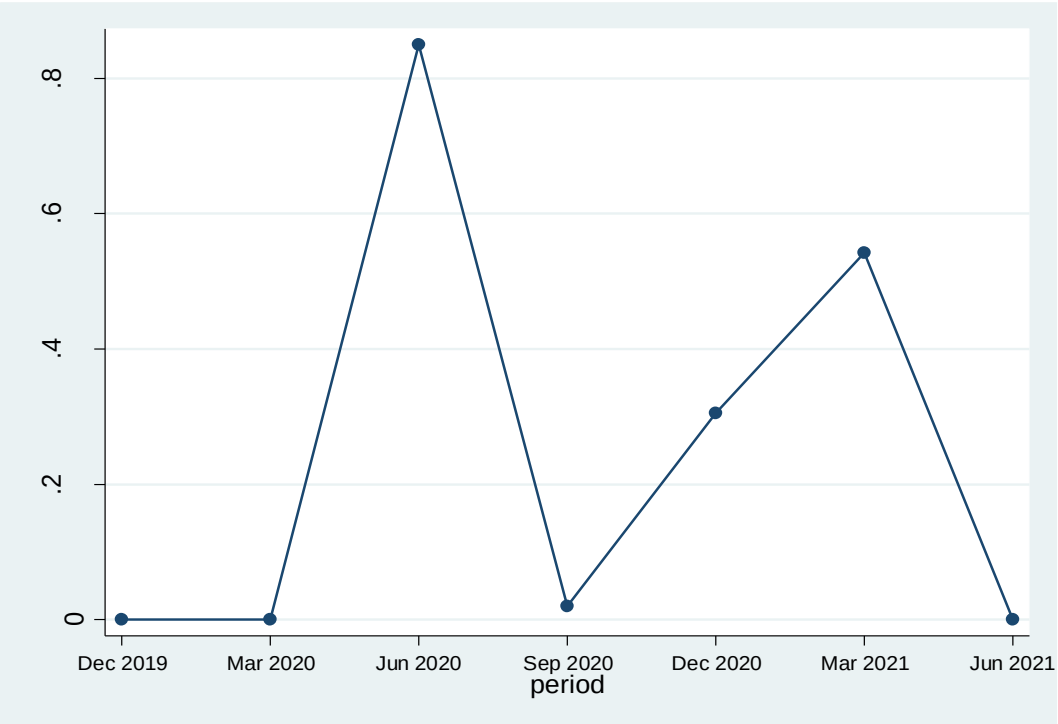
Notes: source ASC-WDS.

Figure 3: Average number of deaths due to COVID-19 at the local authority, Dec 2019-Jun 2021



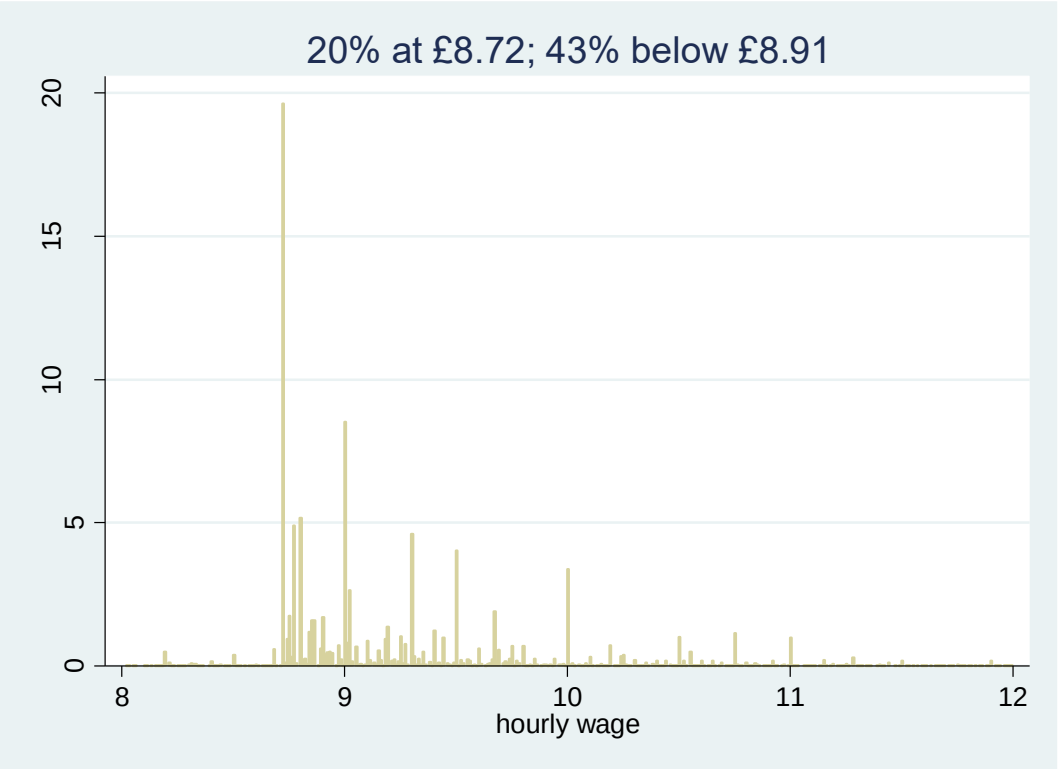
Notes: source ONS. The average number of all deaths at any given period is the total number of all deaths across local authorities in that period divided by the number of local authorities; the average number of deaths in care homes at any given period is the total number of deaths in care homes across local authorities in that period divided by the number of local authorities.

Figure 4: Average number of deaths due to COVID-19 at the individual care home, Dec 2019-June 2021



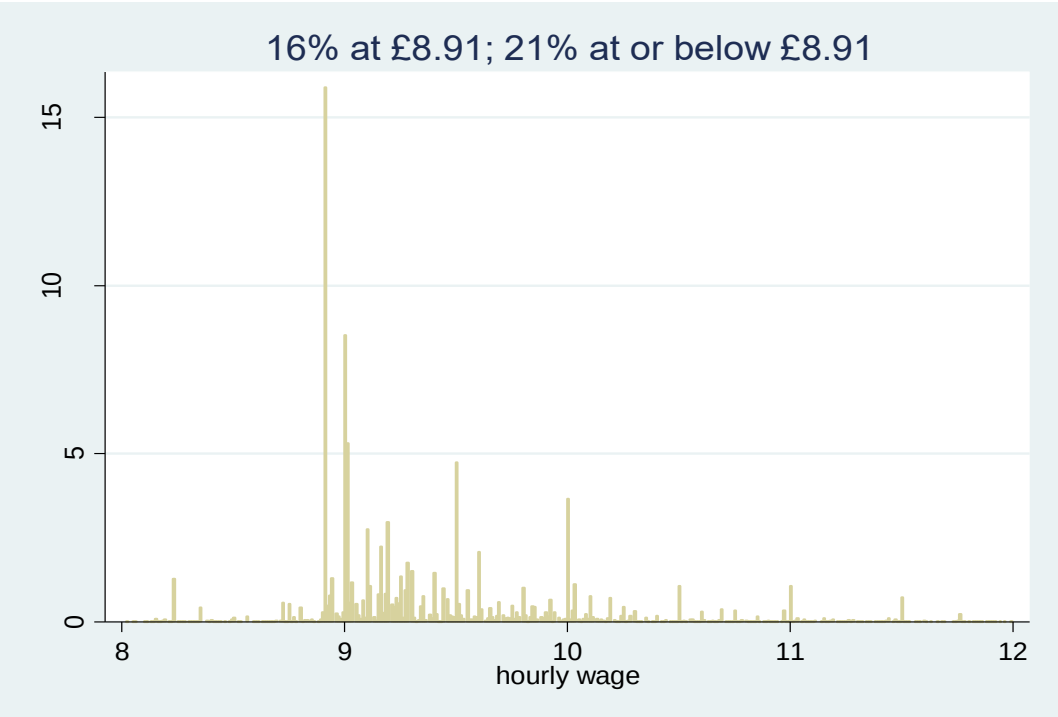
Notes: source CQC. The average number of deaths at the individual care home at any given period is the total number of deaths across care homes in that period divided by the number of care homes.

Figure 5: Hourly wage distribution for care workers, balanced panel, March 2021



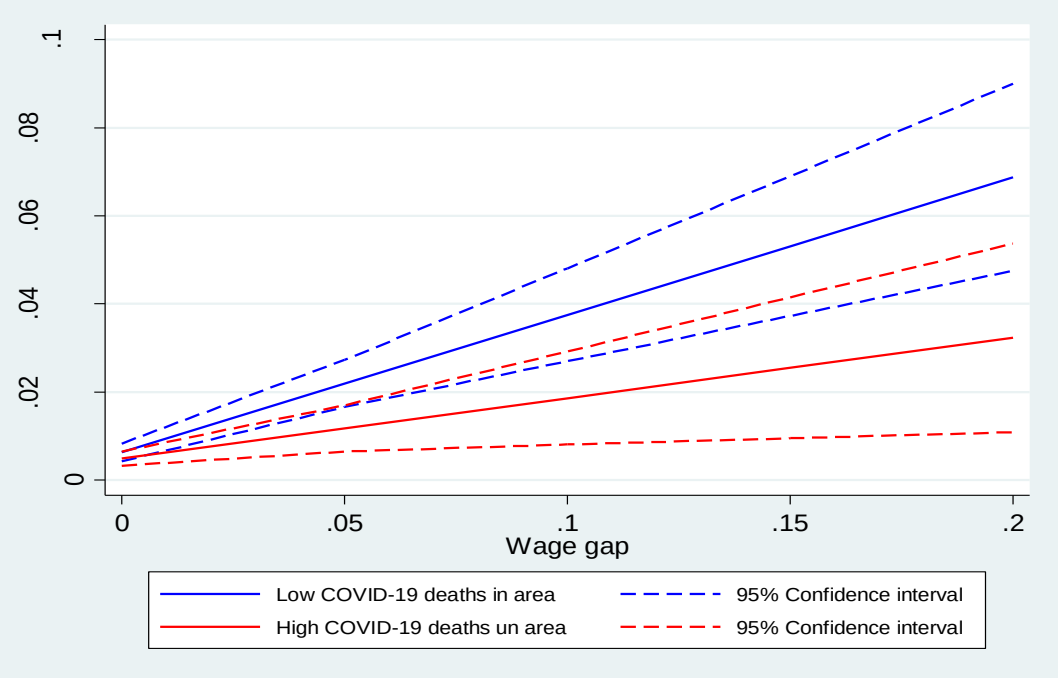
Notes: source ASC-WDS. Care workers exclude senior carers. The sample includes workers with wage information updated in the first quarter, Jan-Mar, of 2021.

Figure 6: Hourly wage distribution for care workers, balanced panel, June 2021



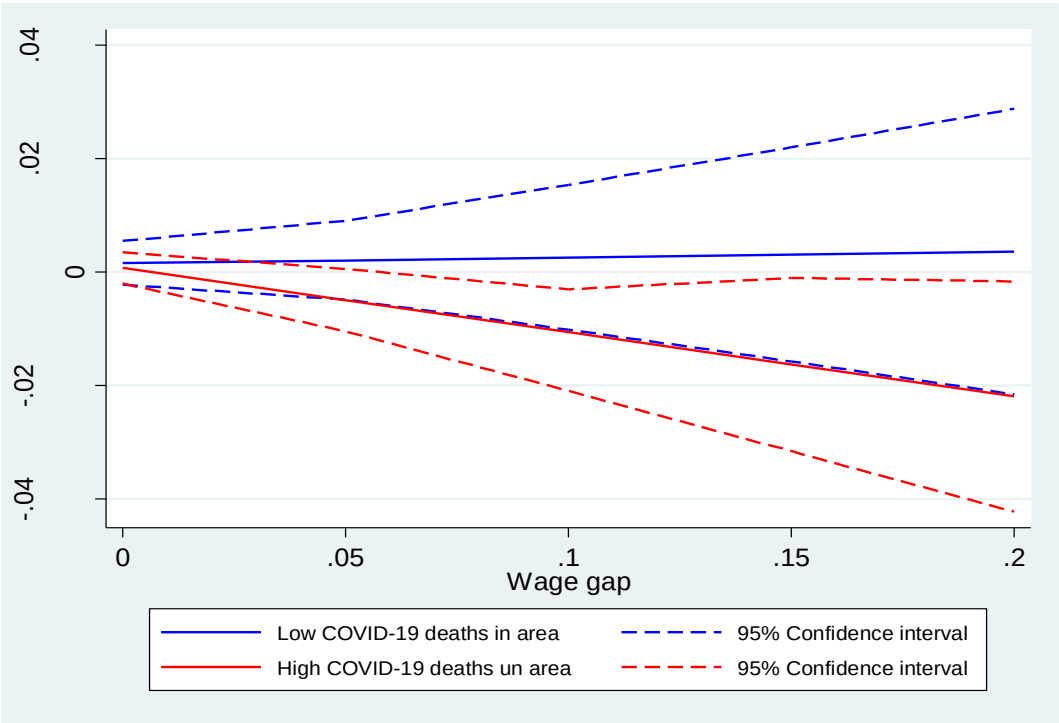
Notes: source ASC-WDS. Care workers exclude senior carers. The Sample includes workers with wage information updated in the second quarter, Apr-Jun, of 2021.

Figure 7: Marginal effects of the minimum wage on firm hourly wage growth by change in COVID-19 deaths in the area



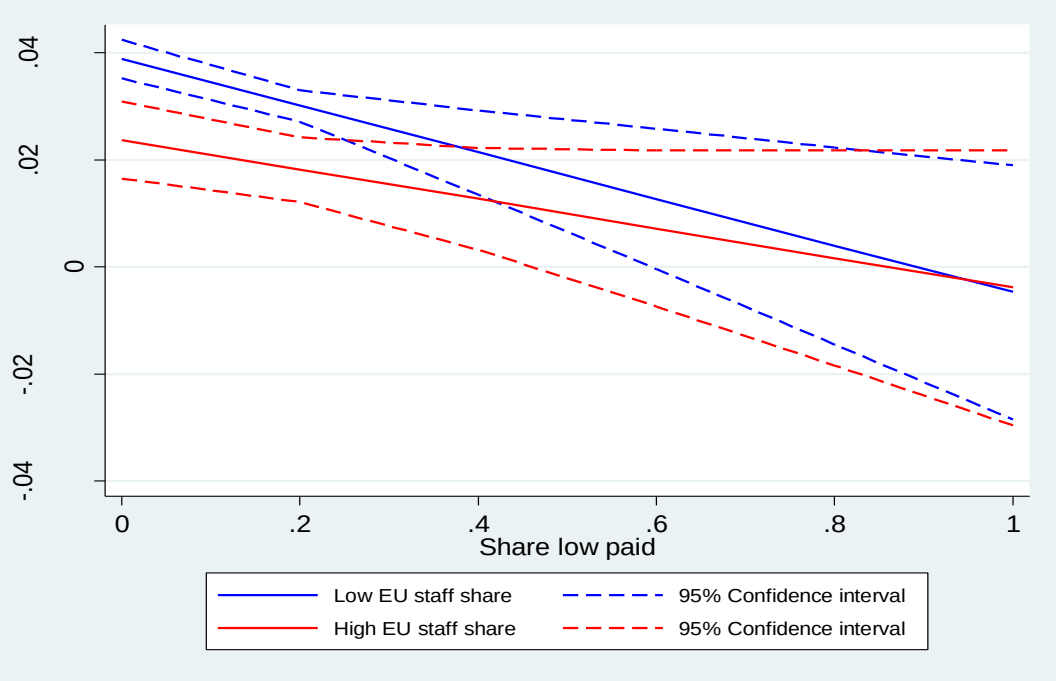
Notes: Marginal effects are calculated using estimation results in specification (5) of Table 3. Low and high COVID-19 deaths correspond to the 25th and 75th percentile of Δlog COVID-19 deaths in area distribution respectively.

Figure 8: Marginal effects of the minimum wage on firm employment growth by change in COVID-19 deaths in the area



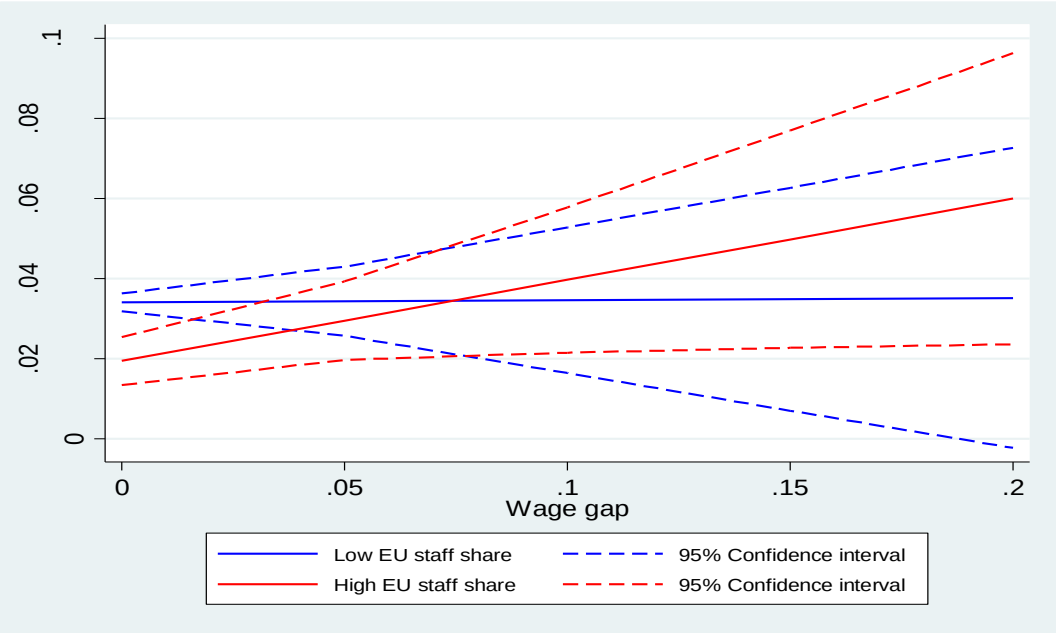
Notes: Marginal effects are calculated using estimation results in specification (4) of Table 4. Low and high COVID-19 deaths correspond to the 25th and 75th percentile of the distribution of Δlog COVID-19 deaths in area respectively.

Figure 9a: Marginal total effects of the minimum wage (share low paid) on firm change in total days lost due to sickness by share of EU employees in firm employment



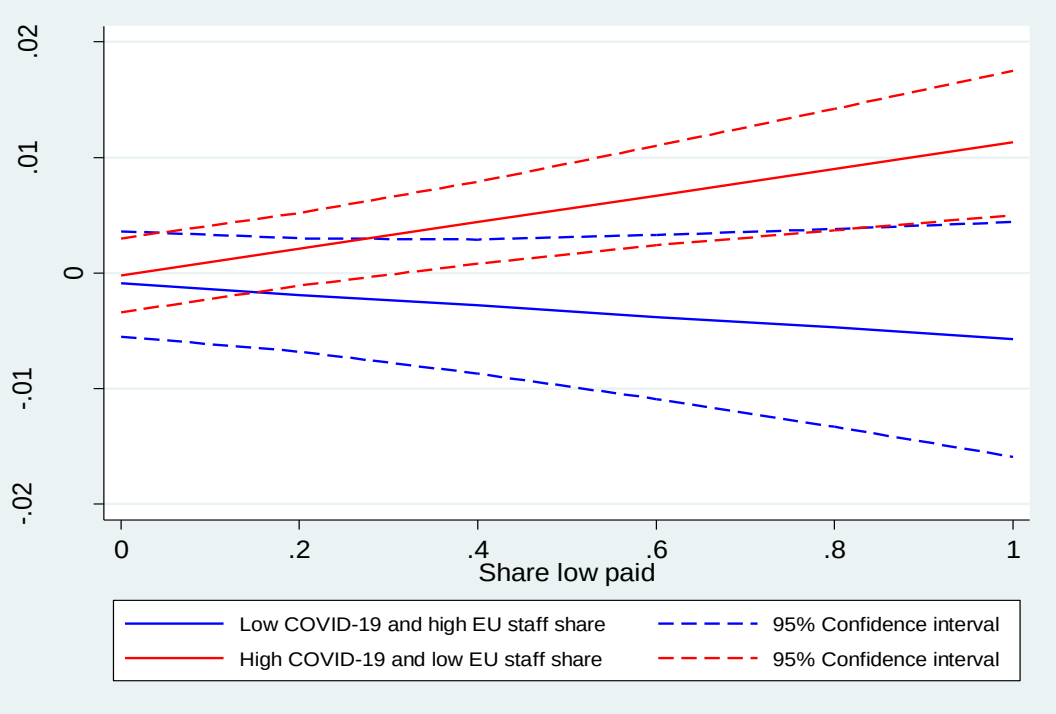
Notes: Marginal effects are calculated using estimation results in specification (3) of Table 11. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Figure 9b: Marginal total effects of the minimum wage (wage gap) on firm change in total annual days lost due to sickness by share of EU employees in firm employment



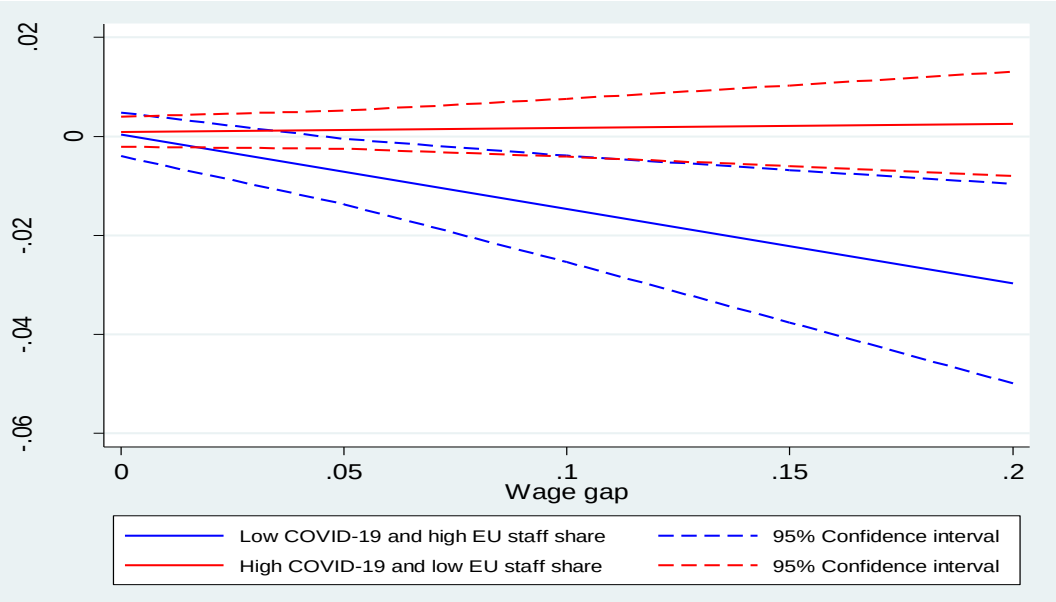
Notes: Marginal effects are calculated using estimation results in specification (6) of Table 11. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Figure 10a: Marginal effects of the minimum wage (share low paid) on firm change in share of staff receiving training by change in COVID-19 deaths in the area and share of EU employees in firm employment



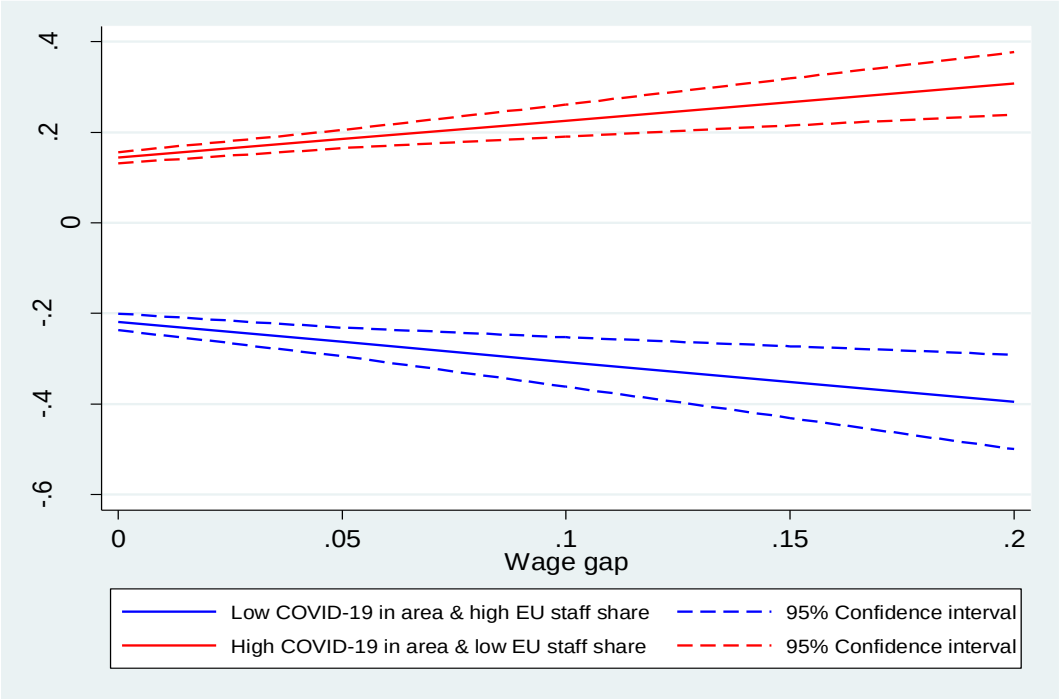
Notes: Marginal effects are calculated using estimation results in specification (2) of Table 12. Low and high COVID-19 deaths correspond to the 25th and 75th percentile of the distribution of Δlog COVID-19 deaths in area respectively. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Figure 10b: Marginal effects of the minimum wage (wage gap) on firm change in share of staff receiving training by change in COVID-19 deaths in the area and share of EU employees in firm employment



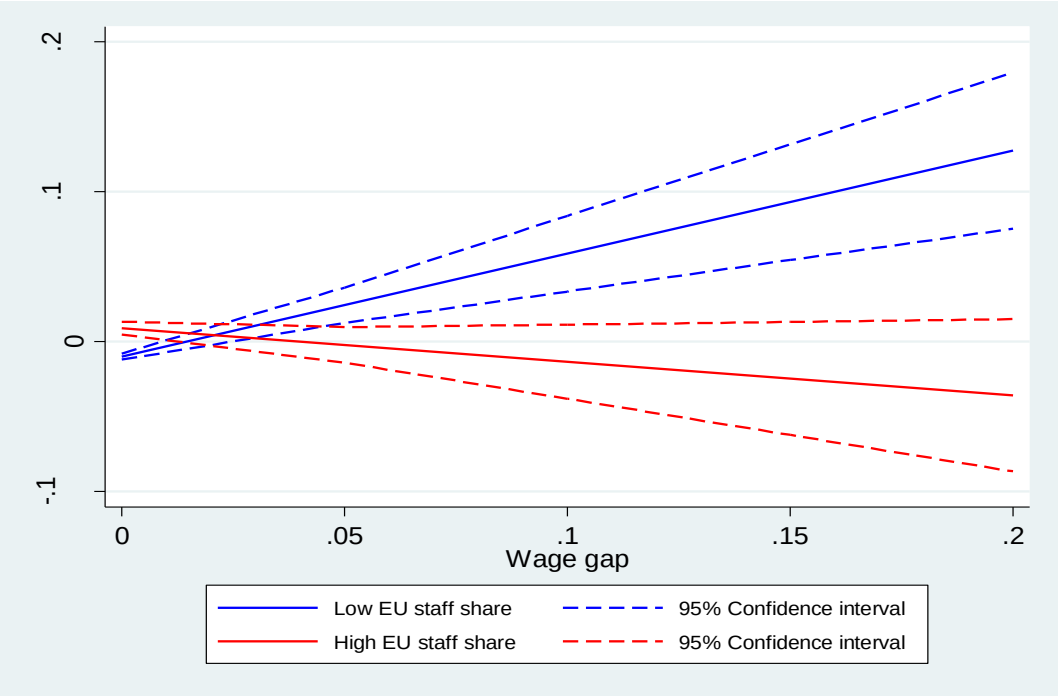
Notes: Marginal effects are calculated using estimation results in specification (4) of Table 12. Low and high COVID-19 deaths correspond to the 25th and 75th percentile of the distribution of Δlog COVID-19 deaths in area respectively. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Figure 11: Marginal *direct* effects of the minimum wage on care home change in COVID-19 deaths at home by change in log COVID-19 deaths in the area and share of EU employees in firm employment



Notes: Marginal effects are calculated using estimation results in specification (5) of Table 14. Low and high COVID-19 deaths correspond to the 25th and 75th percentile of the distribution of Δlog COVID-19 deaths in area respectively. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Figure 12: Marginal *total* effects of the NLW on growth of deaths due to COVID-19 at the home by share of EU employees in firm employment



Notes: Marginal effects are calculated using estimation results in specification (6) of Table 14. Low and high EU staff share correspond to the 25th and 75th percentile of the distribution of the share of EU employees in total firm employment respectively.

Table 1: Descriptive statistics: workers' data, Mar 2021-Jun 2021

	All Firms		Balanced Panel	
	Mar 2021	Jun 2021	Mar 2021	Jun 2021
Hourly wage	11.13	11.24	10.03	10.26
	(4.64)	(4.64)	(3.06)	(2.96)
Low-paid	0.32		0.39	
	(0.47)		(0.49)	
Wage gap	0.02		0.01	
	(0.07)		(0.04)	
Weekly hours	30.71	30.69	31.03	30.63
	(8.99)	(9.00)	(9.23)	(9.44)
Weekly earnings	354.72	358.77	315.80	318.84
	(199.20)	(200.20)	(152.16)	(144.52)
Age	43.79	43.93	43.76	43.93
	(13.20)	(13.23)	(13.21)	(13.23)
Female	0.83	0.83	0.83	0.83
	(0.38)	(0.38)	(0.38)	(0.38)
White	0.83	0.82	0.83	0.83
	(0.38)	(0.38)	(0.38)	(0.38)
British	0.86	0.86	0.86	0.86
	(0.35)	(0.34)	(0.34)	(0.34)
EU	0.07	0.07	0.07	0.07
	(0.25)	(0.25)	(0.25)	(0.25)
Permanent	0.89	0.89	0.89	0.89
	(0.32)	(0.31)	(0.32)	(0.32)
Zero hours	0.21	0.21	0.21	0.21
	(0.41)	(0.41)	(0.41)	(0.41)
Full time	0.56	0.56	0.56	0.56
	(0.50)	(0.50)	(0.50)	(0.50)
Work experience	9.94	9.89	9.92	9.88
	(8.31)	(8.38)	(8.34)	(8.37)
Social care qualification	0.52	0.52	0.52	0.52
	(0.50)	(0.50)	(0.50)	(0.50)
Days lost due to sickness	6.27	6.37	6.34	6.37
	(13.89)	(14.00)	(13.98)	(13.99)
Received training	0.65	0.65	0.65	0.65
	(0.48)	(0.48)	(0.48)	(0.48)
Number of observations	660,030	633,332	627,671	625,038

Notes: figures are averages with standard deviations in parentheses. The balanced panel includes all employees of firms observed in both periods. Low-paid employees are those whose hourly wage in the first quarter (Jan-Mar) is below the level of the National Living Wage in April. Wage gap is the percentage change in the weekly wage bill of the home if hourly wages of all employees who are paid below the NLW in the first quarter is increased at the level of the NLW. Received training denotes whether the employee received training at the current employer.

Table 2: Descriptive statistics: firms' data, Mar 2021-Jun 2021

	All Firms		Balanced Panel	
	Mar 2021	Jun 2021	Mar 2021	Jun 2021
Number of workers	39.37	39.12	39.91	39.71
	(52.97)	(52.79)	(52.46)	(52.36)
Share of employees with individual information	0.89	0.89	0.97	0.97
	(0.29)	(0.29)	(0.12)	(0.11)
Share care workers	0.53	0.53	0.53	0.52
	(0.33)	(0.34)	(0.34)	(0.34)
Part of larger organisation	0.96	0.96	0.96	0.96
	(0.20)	(0.21)	(0.19)	(0.19)
Private	0.54	0.54	0.53	0.53
	(0.50)	(0.50)	(0.50)	(0.50)
CQC regulated	0.70	0.69	0.68	0.68
	(0.46)	(0.46)	(0.47)	(0.47)
Turnover rate	0.23	0.22	0.23	0.22
	(0.27)	(0.27)	(0.27)	(0.27)
Recruitment rate	0.26	0.25	0.25	0.25
	(0.28)	(0.27)	(0.28)	(0.27)
Vacancy rate	0.06	0.06	0.05	0.06
	(0.10)	(0.10)	(0.09)	(0.09)
COVID-19 deaths in locality	213.57	8.50	211.65	8.51
	(157.72)	(9.10)	(154.24)	(9.08)
COVID-19 deaths in care home	0.54	0.00	0.55	0.00
	(1.75)	(0.00)	(1.75)	(0.00)
Number of observations	18,775	18,135	16,296	16,296

Notes: figures are averages with standard deviations in parentheses. The balanced panel includes all firms observed in both periods. Part of a larger organisation includes parent and subsidiary establishments. CQC stands for Care Quality Commission, the independent body regulating care homes in England.

Table 3: Change in care home log average hourly wage equations

	(1)	(2)	(3)	(4)	(5)
Share low-paid (t-1)	0.013***	0.019***	0.019***		
	(0.001)	(0.001)	(0.001)		
Wage gap (t-1)				0.142***	0.147***
				(0.026)	(0.030)
Δlog COVID-19 deaths in area	-0.001	-0.001*		-0.001	-0.001
	(0.001)	(0.001)		(0.001)	(0.001)
T^{BREX} x share EU (t-1)	-0.001	0.007	0.005	-0.001	0.009
	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
Share low-paid x Δlog COVID-19 deaths	-0.001*	-0.001***			
	(0.000)	(0.000)			
Wage gap x Δlog COVID-19 deaths				-0.016**	-0.018**
				(0.007)	(0.007)
Share low-paid x T^{BREX} x share EU	-0.001	0.007	0.005		
	(0.005)	(0.006)	(0.005)		
Wage gap x T^{BREX} x share EU				-0.815	-0.744
				(1.765)	(1.796)
Δlog COVID-19 deaths x T^{BREX} x share EU	0.003*	-0.001		0.004*	0.002
	(0.001)	(0.002)		(0.002)	(0.002)
Share low-paid x Δlog COVID-19 deaths x T^{BREX} x share EU	0.027	0.039*			
	(0.021)	(0.021)			
Wage gap x Δlog COVID-19 deaths x T^{BREX} x share EU				0.202	0.233
				(0.509)	(0.513)
Controls	No	Yes	Yes	No	Yes
Number of observations	55,398	55,398	55,398	55,007	55,007
			Marginal effects		
Share low-paid (t-1)	0.015***	0.022***	0.019***		
	(0.002)	(0.002)	(0.001)		
Wage gap (t-1)				0.204***	0.212***
				(0.040)	(0.043)
Δlog COVID-19 deaths	-0.0002	-0.0006**		-0.0002**	-0.0005
	(0.0002)	(0.0003)		(0.0001)	(0.0003)
T^{BREX} x share EU (t-1)	0.002	0.017	0.004	-0.010	-0.0003
	(0.010)	(0.010)	(0.004)	(0.013)	(0.013)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 4: Change in care home log average weekly earnings equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	0.007***	0.014***		
	(0.002)	(0.003)		
Wage gap (t-1)			0.084***	0.102***
			(0.025)	(0.026)
Δlog COVID-19 deaths	-0.001	0.001	-0.001**	0.001
in area	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	0.004	0.007	0.005	0.008
	(0.009)	(0.010)	(0.009)	(0.010)
Share low-paid x	-0.001	-0.001*		
Δlog COVID-19 deaths	(0.001)	(0.001)		
Wage gap x			-0.014*	-0.014*
Δlog COVID-19 deaths			(0.007)	(0.008)
Share low-paid x	-0.007	-0.067		
T^{BREX} x share EU	(0.139)	(0.128)		
Wage gap x			-4.173	-4.286*
T^{BREX} x share EU			(2.592)	(2.598)
Δlog COVID-19 deaths	0.004	-0.001	0.003	0.001
x	(0.003)	(0.003)	(0.004)	(0.004)
T^{BREX} x share EU				
Share low-paid x	0.028	0.026		
Δlog COVID-19 deaths	(0.035)	(0.033)		
x				
T^{BREX} x share EU				
Wage gap x			-0.535	-0.463
Δlog COVID-19 deaths			(0.718)	(0.715)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	53,955	53,955	53,955	53,955
		Marginal effects		
Share low-paid (t-1)	0.012***	0.019***		
	(0.003)	(0.004)		
Wage gap (t-1)			0.101*	0.126**
			(0.053)	(0.055)
Δlog COVID-19 deaths	-0.0004**	-0.0001	-0.0006**	-0.00007
	(0.0002)	(0.0005)	(0.0002)	(0.0005)
T^{BREX} x share EU (t-1)	-0.003	-0.004	-0.026	-0.023
	(0.017)	(0.018)	(0.019)	(0.020)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 5: Change in log number of employees equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.002	-0.001		
	(0.002)	(0.003)		
Wage gap (t-1)			-0.037*	-0.037
			(0.021)	(0.024)
Δlog COVID-19 deaths	-0.001	-0.001	0.001*	-0.001
in area	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	0.020	0.011	0.018	0.012
	(0.013)	(0.015)	(0.013)	(0.015)
Share low-paid x	0.004***	0.001*		
Δlog COVID-19 deaths	(0.001)	(0.001)		
Wage gap x			0.015**	-0.001
Δlog COVID-19 deaths			(0.007)	(0.007)
Share low-paid x	-0.316**	-0.212		
T^{BREX} x share EU	(0.150)	(0.151)		
Wage gap x			-3.366*	-3.292*
T^{BREX} x share EU			(1.784)	(1.790)
Δlog COVID-19 deaths	0.014***	0.005	0.015***	0.005
x	(0.004)	(0.004)	(0.004)	(0.004)
T^{BREX} x share EU				
Share low-paid x	-0.053	-0.040		
Δlog COVID-19 deaths	(0.036)	(0.036)		
x				
T^{BREX} x share EU				
Wage gap x			-0.404	-0.474
Δlog COVID-19 deaths			(0.433)	(0.452)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	72,363	72,363	71,843	71,843
		Marginal effects (at sample means)		
Share low-paid (t-1)	-0.006*	-0.004		
	(0.004)	(0.004)		
Wage gap (t-1)			-0.053	-0.062
			(0.043)	(0.046)
Δlog COVID-19 deaths	0.0002	-0.0004	0.0003*	-0.0003
	(0.0002)	(0.0006)	(0.0002)	(0.0006)
T^{BREX} x share EU (t-1)	-0.027	-0.013	-0.013	-0.011
	(0.019)	(0.020)	(0.015)	(0.017)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 6: Change in log total weekly hours equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.023***	0.004		
	(0.005)	(0.007)		
Wage gap (t-1)			-0.164***	-0.042
			(0.046)	(0.046)
Δlog COVID-19 deaths	0.004***	0.002	0.004***	0.002
in area	(0.001)	(0.002)	(0.001)	(0.002)
T^{BREX} x share EU (t-1)	0.018	0.018	0.019	0.014
	(0.032)	(0.037)	(0.031)	(0.035)
Share low-paid x	0.002	-0.001		
Δlog COVID-19 deaths	(0.001)	(0.002)		
Wage gap x			0.002	0.009
Δlog COVID-19 deaths			(0.013)	(0.012)
Share low-paid x	0.320	0.211		
T^{BREX} x share EU	(0.565)	(0.551)		
Wage gap x			0.216	-0.073
T^{BREX} x share EU			(2.993)	(3.053)
Δlog COVID-19 deaths	0.015	0.001	0.023***	0.003
x	(0.010)	(0.010)	(0.008)	(0.008)
T^{BREX} x share EU				
Share low-paid x	0.090	0.052		
Δlog COVID-19 deaths	(0.131)	(0.127)		
x				
T^{BREX} x share EU				
Wage gap x			-0.632	-0.495
Δlog COVID-19 deaths			(0.774)	(0.758)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	72,855	72,855	72,326	72,326
			Marginal effects	
Share low-paid (t-1)	-0.015	0.007		
	(0.010)	(0.010)		
Wage gap (t-1)			-0.217**	-0.090
			(0.098)	(0.100)
Δlog COVID-19 deaths	0.003***	0.002	0.003***	0.002
	(0.131)	(0.002)	(0.0004)	(0.002)
T^{BREX} x share EU (t-1)	0.036	0.038	0.007	0.014
	(0.063)	(0.063)	(0.032)	(0.036)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 7: Change in log full time equivalent employment equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.014***	0.005		
	(0.003)	(0.004)		
Wage gap (t-1)			-0.107***	-0.032
			(0.037)	(0.037)
Δlog COVID-19 deaths	0.003***	0.001	0.003***	0.001
in area	(0.000)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	-0.001	-0.001	0.001	-0.001
	(0.019)	(0.021)	(0.018)	(0.021)
Share low-paid x	0.001	0.001		
Δlog COVID-19 deaths	(0.001)	(0.001)		
Wage gap x			0.002	0.006
Δlog COVID-19 deaths			(0.010)	(0.010)
Share low-paid x	0.073	0.098		
T^{BREX} x share EU	(0.249)	(0.259)		
Wage gap x			-0.746	-0.778
T^{BREX} x share EU			(2.210)	(2.251)
Δlog COVID-19 deaths	0.012*	0.001	0.016***	0.003
x	(0.007)	(0.007)	(0.005)	(0.006)
T^{BREX} x share EU				
Share low-paid x	0.024	0.021		
Δlog COVID-19 deaths	(0.058)	(0.060)		
x				
T^{BREX} x share EU				
Wage gap x			-0.131	-0.046
Δlog COVID-19 deaths			(0.518)	(0.501)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	72,895	72,895	72,366	72,366
			Marginal effects	
Share low-paid (t-1)	-0.011**	0.005		
	(0.005)	(0.006)		
Wage gap (t-1)			-0.105**	-0.030
			(0.052)	(0.050)
Δlog COVID-19 deaths	0.002***	0.001	0.002***	0.001
	(0.0003)	(0.001)	(0.0002)	(0.001)
T^{BREX} x share EU (t-1)	-0.003	0.008	-0.015	-0.008
	(0.030)	(0.032)	(0.020)	(0.023)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 8: Change in annual staff turnover rate equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.005**	-0.006**		
	(0.002)	(0.003)		
Wage gap (t-1)			0.003	0.017
			(0.019)	(0.020)
Δlog COVID-19 deaths	0.001	0.001	-0.001	0.001
in area	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	0.023*	0.015	0.023*	0.013
	(0.013)	(0.015)	(0.013)	(0.015)
Share low-paid x	-0.001	0.001		
Δlog COVID-19 deaths	(0.001)	(0.001)		
Wage gap x			-0.006	0.003
Δlog COVID-19 deaths			(0.006)	(0.006)
Share low-paid x	-0.021	-0.130		
T^{BREX} x share EU	(0.193)	(0.198)		
Wage gap x			-1.415	-2.440
T^{BREX} x share EU			(1.664)	(1.681)
Δlog COVID-19 deaths	-0.004	-0.001	-0.003	-0.001
x T^{BREX} x share EU	(0.004)	(0.004)	(0.004)	(0.004)
Share low-paid x	-0.021	-0.028		
Δlog COVID-19 deaths x T^{BREX} x share EU	(0.048)	(0.049)		
Wage gap x			-0.579	-0.509
Δlog COVID-19 deaths x T^{BREX} x share EU			(0.436)	(0.437)
Controls	No	Yes	No	Yes
Number of observations	45,278	45,278	45,085	45,085
		Marginal effects		
Share low-paid (t-1)	-0.006	-0.007		
	(0.004)	(0.004)		
Wage gap (t-1)			-0.040	-0.012
			(0.040)	(0.039)
Δlog COVID-19 deaths	0.0001	0.001	-0.0001	0.001
	(0.0002)	(0.0006)	(0.0002)	(0.0003)
T^{BREX} x share EU (t-1)	0.025	0.002	-0.019	0.001
	(0.022)	(0.023)	(0.013)	(0.015)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 9: Change in annual staff recruitment rate equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.006***	-0.009***		
	(0.002)	(0.003)		
Wage gap (t-1)			-0.016	-0.010
			(0.020)	(0.021)
Δlog COVID-19 deaths	0.001	0.001	0.001	-0.001
in area	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	0.030**	0.006	0.031**	0.006
	(0.013)	(0.015)	(0.013)	(0.015)
Share low-paid x	0.001	-0.001		
Δlog COVID-19 deaths	(0.001)	(0.001)		
Wage gap x			0.003	0.004
Δlog COVID-19 deaths			(0.007)	(0.007)
Share low-paid x	-0.092	-0.045		
T^{BREX} x share EU	(0.267)	(0.271)		
Wage gap x			-3.179	-2.912
T^{BREX} x share EU			(1.953)	(1.934)
Δlog COVID-19 deaths	-0.001	-0.003	0.007**	0.004
x	(0.004)	(0.004)	(0.004)	(0.004)
T^{BREX} x share EU				
Share low-paid x	0.036	0.040		
Δlog COVID-19 deaths	(0.059)	(0.059)		
x				
T^{BREX} x share EU				
Wage gap x			-0.411	-0.396
Δlog COVID-19 deaths			(0.485)	(0.483)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	45,278	45,278	45,085	45,085
			Marginal effects	
Share low-paid (t-1)	-0.005	-0.008		
	(0.005)	(0.005)		
Wage gap (t-1)			-0.048	-0.044
			(0.040)	(0.040)
Δlog COVID-19 deaths	0.0001	-0.001	0.001	-0.001
	(0.0002)	(0.001)	(0.002)	(0.001)
T^{BREX} x share EU (t-1)	0.017	-0.001	0.008	-0.012
	(0.024)	(0.025)	(0.013)	(0.014)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 10: Change in annual vacancy rate equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	0.001	-0.001		
	(0.001)	(0.001)		
Wage gap (t-1)			-0.001	-0.004
			(0.006)	(0.007)
Δlog COVID-19 deaths	-0.001***	0.001	-0.001***	0.001
in area	(0.0004)	(0.001)	(0.0004)	(0.001)
T^{BREX} x share EU (t-1)	0.007	0.003	0.007*	0.003
	(0.004)	(0.005)	(0.004)	(0.005)
Share low-paid x	0.001	0.001*		
Δlog COVID-19 deaths	(0.001)	(0.0006)		
Wage gap x			0.001	0.001
Δlog COVID-19 deaths			(0.002)	(0.002)
Share low-paid x	0.078	0.056		
T^{BREX} x share EU	(0.051)	(0.050)		
Wage gap x			0.764**	0.600*
T^{BREX} x share EU			(0.358)	(0.348)
Δlog COVID-19 deaths	-0.001	-0.001	-0.002	-0.002
x	(0.001)	(0.002)	(0.001)	(0.001)
T^{BREX} x share EU				
Share low-paid x	0.011	0.010		
Δlog COVID-19 deaths	(0.012)	(0.012)		
x				
T^{BREX} x share EU				
Wage gap x			0.051	0.054
Δlog COVID-19 deaths			(0.098)	(0.097)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	43,390	43,390	43,140	43,140
			Marginal effects	
Share low-paid (t-1)	0.009	0.001		
	(0.006)	(0.001)		
Wage gap (t-1)			0.008	0.006
			(0.011)	(0.011)
Δlog COVID-19 deaths	-0.001	0.0002	-0.001	-0.001
	(0.0001)	(0.0002)	(0.0001)	(0.001)
T^{BREX} x share EU (t-1)	0.016***	0.009	0.008***	0.008*
	(0.006)	(0.006)	(0.013)	(0.005)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 11: Change in log annual total days lost due to sickness equations

	(1)	(2)	(3)	(4)	(5)	(6)
Share low-paid (t-1)	-0.043***	-0.035**	-0.045***			
	(0.011)	(0.014)	(0.014)			
Wage gap (t-1)				-0.056	0.092	0.070
				(0.096)	(0.103)	(0.103)
Δlog COVID-19 deaths	0.002*	-0.010***		0.004***	-0.009***	
in area	(0.001)	(0.003)		(0.001)	(0.003)	
T^{BREX} x share EU (t-1)	0.109**	-0.230***	-0.196***	0.096*	-0.235***	-0.191***
	(0.052)	(0.060)	(0.057)	(0.052)	(0.060)	(0.052)
Share low-paid x	0.015***	0.016***				
Δlog COVID-19 deaths	(0.003)	(0.004)				
Wage gap x				0.006	-0.029	
Δlog COVID-19 deaths				(0.028)	(0.028)	
Share low-paid x	-0.810	0.462	0.208*			
T^{BREX} x share EU	(0.715)	(0.711)	(0.125)			
Wage gap x				2.914	12.134**	2.570***
T^{BREX} x share EU				(5.951)	(6.144)	(0.885)
Δlog COVID-19 deaths	0.069***	-0.008		0.079***	-0.027	
x	(0.018)	(0.019)		(0.016)	(0.017)	
T^{BREX} x share EU						
Share low-paid x	-0.109	0.023				
Δlog COVID-19 deaths	(0.169)	(0.168)				
x						
T^{BREX} x share EU						
Wage gap x				0.895	1.417	
Δlog COVID-19 deaths				(0.998)	(1.049)	
x						
T^{BREX} x share EU						
Controls	No	Yes	Yes	No	Yes	Yes
Number of observations	72,855	72,855	72,855	72,326	72,326	72,326
			Marginal effects			
Share low-paid (t-1)	-0.047***	-0.040**	-0.039***			
	(0.016)	(0.016)	(0.013)			
Wage gap (t-1)				0.063	0.156	0.053
				(0.127)	(0.133)	(0.093)
Δlog COVID-19 deaths	0.004***	-0.009***		0.005***	-0.01***	
	(0.001)	(0.003)		(0.001)	(0.003)	
T^{BREX} x share EU (t-1)	-0.024	-0.173*	-0.172***	0.055	-0.143**	-0.174***
	(0.085)	(0.091)	(0.051)	(0.060)	(0.067)	(0.051)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 12: Change in share of staff provided training equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.003*	0.007**		
	(0.002)	(0.003)		
Wage gap (t-1)			-0.080***	-0.055**
			(0.021)	(0.024)
Δlog COVID-19 deaths in area	0.001*	-0.001	0.001	-0.001
	(0.0006)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	-0.019	-0.016	-0.019	-0.016
	(0.014)	(0.016)	(0.013)	(0.016)
Share low-paid x Δlog COVID-19 deaths	0.001	0.003***		
	(0.001)	(0.001)		
Wage gap x Δlog COVID-19 deaths			0.024***	0.032***
			(0.007)	(0.008)
Share low-paid x T^{BREX} x share EU	-0.232*	-0.261*		
	(0.135)	(0.138)		
Wage gap x T^{BREX} x share EU			-0.419	-0.528
			(1.714)	(1.746)
Δlog COVID-19 deaths x T^{BREX} x share EU	0.003	0.003	0.001	0.003
	(0.004)	(0.005)	(0.003)	(0.004)
Share low-paid x Δlog COVID-19 deaths x T^{BREX} x share EU	-0.058*	-0.054		
	(0.034)	(0.034)		
Wage gap x Δlog COVID-19 deaths x T^{BREX} x share EU			-0.289	-0.284
			(0.373)	(0.377)
Controls	No	Yes	No	Yes
Number of observations	38,477	38,477	38,074	38,074
			Marginal effects	
Share low-paid (t-1)	-0.008**	0.002		
	(0.003)	(0.004)		
Wage gap (t-1)			-0.108**	-0.082*
			(0.042)	(0.045)
Δlog COVID-19 deaths	0.0004	-0.0001	0.0005**	0.0001
	(0.0002)	(0.0007)	(0.0002)	(0.0001)
T^{BREX} x share EU (t-1)	-0.046**	-0.047**	-0.021	-0.021
	(0.019)	(0.021)	(0.017)	(0.019)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 13: Change in share of staff on zero hours equations

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	-0.001	0.001		
	(0.001)	(0.001)		
Wage gap (t-1)			0.007	0.016
			(0.010)	(0.011)
Δlog COVID-19 deaths	0.001	-0.001	0.001	-0.001
in area	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	-0.003	0.001	-0.004	0.001
	(0.003)	(0.004)	(0.003)	(0.004)
Share low-paid x	0.001**	-0.001		
Δlog COVID-19 deaths	(0.0005)	(0.001)		
Wage gap x			0.003	-0.001
Δlog COVID-19 deaths			(0.002)	(0.002)
Share low-paid x	-0.095*	-0.073		
T^{BREX} x share EU	(0.051)	(0.051)		
Wage gap x			-0.397	-0.297
T^{BREX} x share EU			(0.371)	(0.330)
Δlog COVID-19 deaths	0.003**	0.001	0.002*	0.001
x	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU				
Share low-paid x	-0.027**	-0.023*		
Δlog COVID-19 deaths	(0.013)	(0.013)		
x				
T^{BREX} x share EU				
Wage gap x			-0.082	-0.063
Δlog COVID-19 deaths			(0.089)	(0.082)
x				
T^{BREX} x share EU				
Controls	No	Yes	No	Yes
Number of observations	72,671	72,671	72,156	72,156
			Marginal effects	
Share low-paid (t-1)	-0.002*	-0.001		
	(0.001)	(0.001)		
Wage gap (t-1)			0.002	0.013
			(0.010)	(0.010)
Δlog COVID-19 deaths	0.0002	0.0001	0.0003	-0.0001
	(0.0006)	(0.006)	(0.0005)	(0.0002)
T^{BREX} x share EU (t-1)	-0.014***	-0.007	-0.007**	-0.001
	(0.006)	(0.006)	(0.003)	(0.003)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table 14: Change in log number of deaths due to COVID-19 in care home equations

	(1)	(2)	(3)	(4)	(5)	(6)
Share low-paid (t-1)	0.116***	-0.051***	-0.028**			
	(0.011)	(0.014)	(0.014)			
Wage gap (t-1)				0.875***	-0.041	0.116
				(0.135)	(0.118)	(0.113)
Δlog COVID-19 deaths in area	0.072***	0.067***		0.075***	0.067***	
	(0.001)	(0.003)		(0.001)	(0.003)	
T^{BREX} x share EU (t-1)	0.825***	0.436***	0.419***	0.750***	0.395***	0.248***
	(0.057)	(0.059)	(0.043)	(0.056)	(0.058)	(0.037)
Share low-paid x Δlog COVID-19 deaths	0.025***	0.023***				
	(0.003)	(0.004)				
Wage gap x Δlog COVID-19 deaths				0.172***	0.093***	
				(0.033)	(0.031)	
Share low-paid x T^{BREX} x share EU	-1.136	-0.359	-2.053***			
	(1.250)	(1.232)	(0.233)			
Wage gap x T^{BREX} x share EU				-29.155***	-18.409**	-11.836***
				(9.334)	(9.023)	(2.215)
Δlog COVID-19 deaths x T^{BREX} x share EU	0.049**	0.078***		0.092***	0.105***	
	(0.022)	(0.023)		(0.022)	(0.023)	
Share low-paid x Δlog COVID-19 deaths x T^{BREX} x share EU	0.785**	0.711**				
	(0.341)	(0.335)				
Wage gap x Δlog COVID-19 deaths x T^{BREX} x share EU				4.853	4.043	
				(3.474)	(3.098)	
Controls	No	Yes	Yes	No	Yes	Yes
Number of observations	72,895	72,895	72,895	72,366	72,366	72,366
			Marginal effects			
Share low-paid (t-1)	0.200***	0.028	-0.010			
	(0.029)	(0.030)	(0.013)			
Wage gap (t-1)				1.864***	0.800***	0.466***
				(0.373)	(0.326)	(0.114)
Δlog COVID-19 deaths	0.076***	0.071***		0.078***	0.069***	
	(0.011)	(0.003)		(0.001)	(0.003)	
T^{BREX} x share EU (t-1)	0.596***	0.282**	0.185***	0.470***	0.470***	0.170***
	(0.137)	(0.137)	(0.035)	(0.074)	(0.074)	(0.034)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

References

Angrist J and Pischke S (2009) *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton: Princeton University Press.

Bessa, I., Forde, C., Moore, S., and Stuart, M. (2013). *The National Minimum Wage, Earnings and Hours in the Domiciliary Care Sector*, Report to the Low Pay Commission (LPC).

Blundell, R. and Costa Dias, M. (2009). "Alternative Approaches to Evaluation in Empirical Microeconomics", *Journal of Human Resources*, 44, 565-640.

Card, D. and Krueger, A. (1995) *Myth and Measurement: The New Economics of Minimum Wages.* Princeton University Press, Princeton, New Jersey.

Care of Quality Commission (CQC) (2020). *The State of Health Care and Adult Social Care in England 2019/20"*. Report.

Christl, M., Kopl-Turyna, M., and Kuscera, D. (2018). "Revisiting the Employment Effects of Minimum Wages in Europe", *German Economic Review*, 19, 426-65.

Datta, N., Giupponi, G., and Machin, S. (2019). "Zero-Hours Contracts and Labour Market Policy", *Economic Policy,* 34, 369–427.

Draca, M., Machin, S., and Van Reenen, J. (2011). "Minimum Wages and Firm Profitability", *American Economic Journal: Applied Economics*, 33, 129-151.

Dolton, P. and Bondibene, C. (2012). "The International Experience of Minimum Wages in an Economic Downturn", *Economic Policy*, 27(69): 99–142.

Dolton, P. Nguyen, D., Castellanos, M., Rolfe, H. (2018). *Brexit and the Health and Social Care Workforce*, NIESR report.

Gardiner, L. (2016). *Rising to the Challenge: Early Evidence on the Introduction of the National Living Wage in the Social Care Sector,* Briefing, Resolution Foundation.

Georgiadis, A. (2006) "Is the Minimum Wage Efficient? Evidence of the Effects of the UK National Minimum Wage in the Residential Care Homes Sector", *Centre for Market and Public Organisation (CMPO) Working Paper*, No. 06/160.

Georgiadis, A. (2013) "Efficiency Wages and the Economic Effects of the Minimum Wage: Evidence from a Low-Wage Labour Market" *Oxford Bulletin of Economics and Statistics,* 75, 962-979.

Giupponi, G., Lindner, A. Machin, S. and Manning, A. (2017) *The Impact of the National Living Wage on English Care Homes*, Report to the Low Pay Commission (LPC).

Giupponi, G. and Machin, S. (2018) "Changing the Structure of Minimum Wages: Firm Adjustment and Wage Spillovers", CEP Discussion Paper no. 1533.

LPC (2020) "*Low Pay Commission Report 2020: National Minimum Wage"*. LPC.

Machin, S. Manning, A., and Rahman L. (2003) 'Where the Minimum Wage Bites Hard: The Introduction of the UK National Minimum Wage to a Low Wage Sector', *Journal of the European Economic Association*, 1, 154-80.

Machin, S. and Wilson, J. (2004). "Minimum Wages in a Low Wage Labour Market: Care Homes in the UK", *Economic Journal*, 114, 102-109.

Machin, S., Manning, A., and Rahman L. (2003). "Where the Minimum Wage Bites Hard: The Introduction of the UK National Minimum Wage to a Low Wage Sector", *Journal of the European Economic Association*, 1, 154-80.

Manning, A. (2003). *Monopsony in Motion: Imperfect Competition in Labor Markets*. Princeton, NJ: Princeton University Press.

Manning, A. (2016). "The Elusive Employment Effect of the Minimum Wage", CEP Discussion paper no. 1428.

Manning, A. and Petrongolo, B. (2017). "How Local Are Labor Markets? Evidence from a Spatial Job Search Model", *American Economic Review*, 107, 2877-907.

Office of National Statistics (ONS) (2021). *Death Registrations and Occurrences by Local Authority and Health Board,* https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeathdatasets/deathregistrationsandoccurrencesbylocalauthorityandhealthboard

Skills for Care (2020). *The State of the Adult Social Care and Workforce in England*, Skills for Care Report.

Vadean, F. and Allan, S. (2020). "The Effects of Minimum Wage Policy on the Long-Term Care Sector", *British Journal of Industrial Relations*, 59, 307-334.

Young, A. (2019). "Channeling Fisher: Randomization Tests and the Statistical Insignificance of Seemingly Significant Experimental Results", *Quarterly Journal of Economics*, 134**,** 557-98.

APPENDIX

Table A1: Definitions of Variables

Notation	Measures
	Treatment Variables
MW_{ist-1}:	Share low-paid: share of employees in home i in period $t-1$ paid below the NLW in period t Wage gap: the proportional increase in the weekly wage bill if the wages of all workers paid below the NLW in period $t-1$ are raised to reach the NLW in period. It is expressed by the following equation: $$GAP_i = \frac{\sum_j h_{ji} max\{W^{min} - W_{ji}, 0\}}{\sum_j h_{ji} W_{ji}}$$ where h_{ji} are weekly hours of worker j in home i in period $t-1$; W_{ji} is hourly wage worker j in home i in period $t-1$; and W^{min} is the level of the NLW in period t
T^{MW}	Dummy variable taking the value 1 for observations in periods when the minimum wage is increased, e.g., April 2020, April 2021, and 0 otherwise
$\Delta DC19_{st}$	Change in log deaths due to COVID-19 in area s, excluding deaths due to COVID-19 at the individual home, in period t
SH^{EU}_{ist-1}	Share EU: share of employees with EU nationality in total employment of home i in period $t-1$
T^{BREX}	Dummy variable taking the value 1 for observations in periods when Brexit is enacted, e.g., January 2021 to June 2021
	Control variables
$\boldsymbol{X_{ist-1}}$	Share of female employees in home i, (operating in area s) in period $t-1$ Average age employees in home i in period $t-1$ Share of white employees in home i in period $t-1$ Share of employees with permanent contract in home i in period $t-1$ Share of full-time employees in home i in period $t-1$ Average years of experience in adult social care of employees in home i in period $t-1$ Share of employees with a social care qualification in home i in period $t-1$ Share of employees who are care assistants in home i in period $t-1$ Set of dummy variables indicating whether home i in period $t-1$ is parent organization, subsidiary establishment, or independent establishment

	Dummy variable taking the value 1 if establishment is regulated by the Care Quality Commission (CQC) and 0 otherwise
	Set of ownership-type dummy variables indicating whether home i in period $t-1$ is part of local authority, private organization, voluntary/charity, or other
	Set of main service dummy variables indicating whether home i main service in period $t-1$ is adult residential, adult day, adult domiciliary, adult community care, children residential, healthcare, or other
	Set of dummy variables for period
	Dummy variables for imputed missing values of control variables, except for type of ownership and period

Table A2: Hourly wage change equations, Mar-Jun 2015

	(1)	(2)	(3)	(4)	(5)
Share low-paid (t-1)	0.013***			0.019***	
	(0.001)			(0.003)	
Wage gap (t-1)		0.091***			0.103**
		(0.029)			(0.041)
Share EU (t-1)			-0.011	-0.008	-0.007
			(0.012)	(0.014)	(0.013)
Share low-paid x				0.001	
Share EU				(0.024)	
Wage gap x					-0.058
Share EU					(0.260)
Number of observations	15,702	15,013	10,018	10,018	9,671

***significant at 1%, **significant at 5%, *significant at 10%; OLS estimates, robust standard errors in parentheses. The share low-paid and the wage gap were calculated using the National Minimum Wage adult rate in October 2015. All specifications include controls for average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), and dummies for missing values of workers' characteristics.

Table A3: Anticipation effects of the minimum wage on hourly wage growth

	(1)	(2)	(3)	(4)
Share low-paid (t-1)	0.010***	0.017***		
	(0.001)	(0.002)		
Share low-paid (t)	-0.006***	-0.003**		
	(0.001)	(0.002)		
Wage gap (t-1)			0.118***	0.130***
			(0.031)	(0.034)
Wage gap (t)			-0.056**	-0.044
			(0.024)	(0.027)
Δlog COVID-19 deaths in area	-0.001	-0.001	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
T^{BREX} x share EU (t-1)	0.007	0.013*	0.009	0.018**
	(0.006)	(0.007)	(0.008)	(0.008)
Share low-paid (t-1) x Δlog COVID-19 deaths	-0.001**	-0.001***		
	(0.0005)	(0.0004)		
Share low-paid (t) x Δlog COVID-19 deaths	-0.001	-0.001		
	(0.001)	(0.001)		
Wage gap (t-1) x Δlog COVID-19 deaths			-0.016**	-0.018**
			(0.007)	(0.007)
Wage gap (t) x Δlog COVID-19 deaths			-0.029*	-0.035**
			(0.016)	(0.017)
Share low-paid (t-1) x T^{BREX} x share EU	0.035	0.077		
	(0.083)	(0.084)		
Share low-paid (t) x T^{BREX} x share EU	-0.016	-0.020		
	(0.018)	(0.018)		
Wage gap (t-1) x T^{BREX} x share EU			-1.108	-1.081
			(2.006)	(2.000)
Wage gap (t) x T^{BREX} x share EU			-0.256	-0.320
			(0.385)	(0.386)
Δlog COVID-19 deaths x T^{BREX} x share EU	0.004**	-0.001	0.005	0.003
	(0.002)	(0.002)	(0.003)	(0.003)
Share low-paid (t-1) x Δlog COVID-19 deaths x T^{BREX} x share EU	-0.013	-0.010		
	(0.011)	(0.011)		
Share low-paid (t) x Δlog COVID-19 deaths x T^{BREX} x share EU	-0.001	0.003		
	(0.016)	(0.016)		
Wage gap (t-1) x Δlog COVID-19 deaths x T^{BREX} x share EU			0.201	0.227
			(0.530)	(0.532)
Wage gap (t) x Δlog COVID-19 deaths x T^{BREX} x share EU			0.426	0.426
			(0.502)	(0.504)
Controls	No	Yes	No	Yes
Number of observations	55,398	55,398	54,539	54,539
			Marginal effects	
Share low-paid (t-1)	0.013***	0.021***		
	(0.002)	(0.002)		
Share low-paid (t)	-0.005***	-0.003*		
	(0.001)	(0.002)		
Wage gap (t-1)			0.175***	0.189***
			(0.046)	(0.050)
Wage gap (t)			-0.060**	-0.043
			(0.030)	(0.032)

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home; T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage

impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table A4: Effects of the minimum wage and Brexit on change in log deaths due to COVID-19 in the area, excluding deaths at the individual home

	(1)	(2)	(3)	(4)	(5)
Share low-paid (t-1)	0.177***			0.315***	
	(0.016)			(0.020)	
Wage gap (t-1)		1.129***			1.637***
		(0.149)			(0.190)
T^{BREX} x share EU (t-1)			0.657***	0.974***	0.841***
			(0.042)	(0.055)	(0.050)
Share EU (t-1)			-0.323***	-0.351***	-0.366***
			(0.083)	(0.092)	(0.090)
Share low-paid (t-1) x T^{BREX} x share EU				-1.194***	
				(0.211)	
Wage gap (t-1) x T^{BREX} x share EU					-6.314**
					(2.457)
Share low-paid (t-1) x share EU				-1.134***	
				(0.161)	
Wage gap (t-1) x share EU					-6.480***
					(2.072)
Number of observations	97,009	96,415	78,216	72,895	72,366

***significant at 1%, **significant at 5%, *significant at 10%; fixed effects estimates, standard errors clustered at the home level in parentheses. T^{BREX} is an indicator taking the value 1 for observations in periods when the new trade relationship between the UK and the EU is enacted and is zero otherwise. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary sector), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, dummies for missing values of sector, and period dummies.

Table A5: Anticipation effects of Brexit on change in vacancy rate and log total days lost due to sickness, Mar-Jun 2020

	Vacancy rate		Log total days lost due to sickness	
	(1)	(2)	(3)	(4)
Wage gap (t-1)	0.014	0.020	0.127	0.071
	(0.012)	(0.013)	(0.472)	(0.483)
Δlog COVID-19 deaths in area	0.001**	0.001**	-0.016*	-0.013
	(0.000)	(0.000)	(0.009)	(0.009)
Share EU (t+2)	-0.006	-0.007	0.262	0.266
	(0.007)	(0.007)	(0.183)	(0.189)
Wage gap x	-0.005	-0.007	-0.007	-0.033
Δlog COVID-19 deaths	(0.004)	(0.005)	(0.168)	(0.168)
Wage gap (t-1) x	1.485	1.482	-18.507	-20.431
Share EU (t+2)	(1.952)	(1.970)	(23.137)	(23.505)
Δlog COVID-19 deaths x	0.003	0.003	-0.153	-0.157
Share EU (t+2)	(0.003)	(0.003)	(0.096)	(0.101)
Wage gap x	-0.446	-0.443	13.514	13.770
Δlog COVID-19 deaths x	(0.764)	(0.770)	(10.951)	(11.237)
Share EU (t+2)				
Controls	No	Yes	No	Yes
Number of observations	6,405	6,405	10,038	10,038
			Marginal effects	
Share EU (t+2)	0.015	0.014	0.255	0.208
	(0.013)	(0.013)	(0.161)	(0.200)

***significant at 1%, **significant at 5%, *significant at 10%; OLS estimates, robust standard errors in parentheses. Marginal effects are evaluated at sample means. COVID-19 deaths in the area exclude deaths at the individual home. All specifications include the lagged one period share of EU employees at the home and all its interactions with the relevant minimum wage impact measure and the change in log deaths due to COVID-19 in the area, but their coefficients are not reported. Controls include average age, shares of female, white, British, permanent, full-time, with social care-related qualification, with individual information, care workers, average experience in adult social care, dummies for whether the establishment is part of larger organisation (parent, subsidiary, or independent), a dummy for whether the establishment is CQC-regulated, sector dummies (private, local authority, or voluntary), dummies for service provided (residential, domiciliary, day, or community care), dummies for missing values of workers' characteristics, and dummies for missing values of sector.