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**Accidents will
happen:
(de)regulation
of health and
safety
legislation,
workplace
accidents and
self
employment**

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Abstract

In 2015, the UK government exempted “low-risk” self-employed workers from legislation on workplace safety. This reversed a move two decades earlier that incorporated the self-employed more fully into the same regulatory framework as employees. This paper examines whether workplace accidents among self-employed workers shifted after these two changes to safety regulations. A difference-in-differences estimation framework suggests that the extension of regulation in 1999 had little impact on relative accident rates. In contrast, after 2015, accident rates for high and low risk self-employed converged, driven primarily by a steep fall in accident rates among those still covered by legislation.

Keywords: non-fatal workplace accidents, self employed, de-regulation, health and safety

JEL: J8; J28; K32; R41

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1. Introduction

One notable feature of the British labour market over the last few decades has been the near secular decline in the rate of workplace accidents. The UK's Health and Safety Executive (HSE), reported 142 deaths at work in Britain for 2020/21 (HSE 2021), down from 651 in 1974, with a further 60 members of the public killed due to workplace incidents. This now compares favourably with rates observed across much of the rest of Europe, (Eurostat 2020). Non-fatal workplace accident rates have been improving too. Information on non-fatal workplace accidents in Britain is now measured officially based on responses to the Labour Force Survey (LFS). Figure I (Panel A), illustrates the long-term decline in non-fatal workplace accidents, for both employed and self-employed workers. Over the quarter century to 2019 the percentage of workers reporting an accident at work dropped from 5% to 2%, some 600,000 incidents a year, involving 550,000 workers, in 2019.¹

However, Figure 1 also shows that the non-fatal accident rate for the self employed has declined at a much slower rate than for employees. Indeed since 2012, the accident rate for the self employed has consistently exceeded that for employees. As a result, the self-employed share of non-fatal workplace accidents has grown from 12% to 18% since 1993. Among the self employed, accident rates are consistently higher among own account self employed workers – those without employees - rather than among self employed workers with employees, (panel B) – though accident rates for both groups have fallen over time.

The trend toward greater relative risk for the self-employed appears to be mirrored in the HSE data on fatalities at work in the UK. Although only 16% of the workforce was self employed in 2021, 38% of these fatalities were among self-employed workers (HSE, 2021). In

¹ The discrepancy is because some individuals have more than one accident. The HSE estimates that the British economy lost 3.9 million days due to accidents in 2016/17, at a cost of £5.2 billion in a combination of lost output, wages, health and compensation outlays. Some 57% per cent of this burden falls upon the workers themselves, (HSE 2018), largely because statutory sick pay does not fully compensate lost earnings, Mazzolini (2020).

1981, the earliest year for which data are available, 11%, of fatalities were among the self employed who then comprised around 9% of the workforce. Similar patterns of accident rates by employment status have been found elsewhere, see for example OSHA (2002) for the USA, Targoutzidis and Karakoltsidis (2009) for Europe; and James (1993) and Mayhew and Quinlan (2006) for Australia.

It seems that self employment in Britain, has become relatively more risky than in the past. Recent research for the UK and the USA, suggests that a rising share of self employment in the workforce, driven predominantly by rising numbers of own account workers, has been accompanied by under-employment, limited flexibility and, in the UK, low earnings, (Boeri, Giupponi, Kreuger and Machin (2020), Giupponi and Xu (2020)). Increased riskiness at work is therefore another important dimension of workplace inequality worth examining.

This diverging accident risk may be due to shifts in the demographic composition or occupations of the self employed compared with employees, changes in the nature of certain jobs, changes in the regulatory framework covering workplace safety or some combination of these factors. It seems pertinent to try to clarify which of these explanations might help to explain the changing incidence of workplace accidents by employment status.

The reputation of health and safety rules and such regulations in the UK has deteriorated over recent decades, with a political narrative that red tape inhibits business. Such perceptions have encouraged recent governments to explore deregulation of occupational safety. No-one – to our knowledge – has explored the links between occupational safety legislation, non-fatal accident rates and self employment.

Two acts of UK legislation offer an opportunity to analyse this issue. In 1999, self-employed workers were more fully incorporated into the British regulatory framework covering responsibility for health and safety, extending their legal duty of care for themselves and those affected by their work. Sixteen years later, in October 2015, the British government

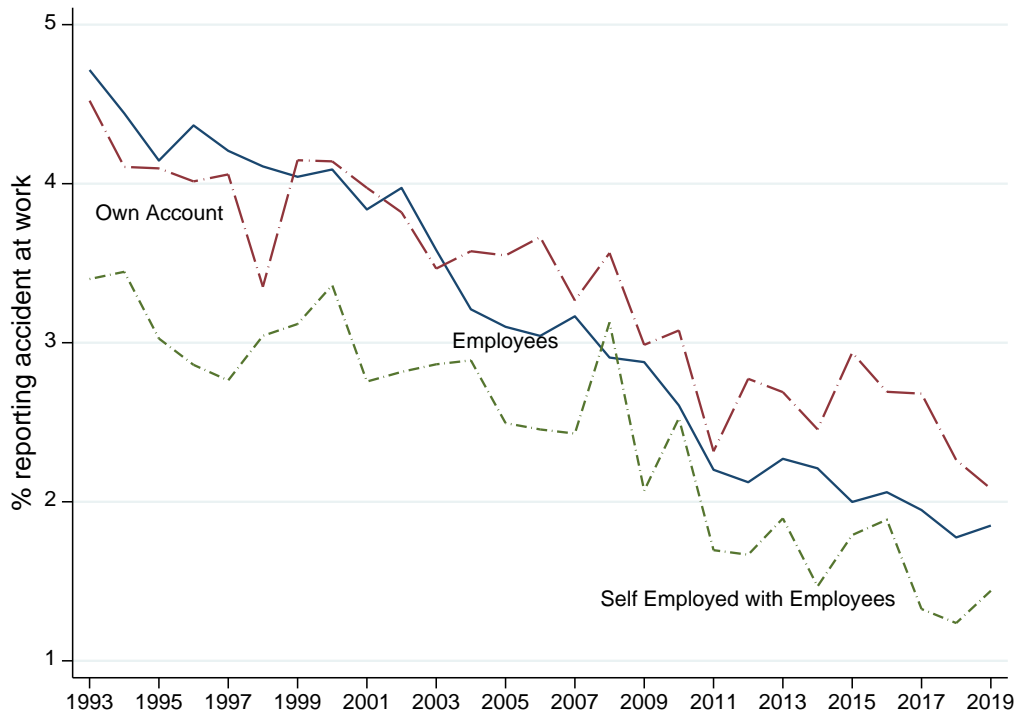
changed tack by introducing legislation that exempted a sub-set of self-employed workers - in designated “low-risk” sectors - from regulation that, among other things, meant they were no longer covered by HSE remits ensuring workplace safety and so they would no longer be subject to safety regulations or inspections.

Figure 1. Workplace Accident Rate by Employment Status: 1993-2019

Panel A



Panel B



Source: LFS author calculations

We investigate whether these two discrete changes in the law can help explain the shifts in self-employment accident rates relative to those of employees. We focus on the potential impact of the legislation on own account self employed since self-employed workers with employees have had to enact and administer the Health & Safety legislation for themselves and their workforce since the 1974 Act. We use difference-in-differences frameworks before and after each respective change in legislation to compare relative changes in non-fatal accident rates between the self employed and employees. For the 2015 change we also undertake a triple differences analysis with two distinct control groups: the self employed who remain covered by health and safety laws and employees in the same sectors exempted from legislation. Our analysis of the impact of these changes therefore provides information on the net costs and benefits arising which may help to inform the debate over regulatory policy in this area.

The following section discusses the legislative environment covering health and safety in British workplaces and the two changes in the law on which we focus. Next, we review the existing literature on risk and self employment. We then outline the data and estimation procedure used to try to identify any effects from these regulatory changes. Subsequently we present results which suggest that relative accident rates were unchanged by the extension of legislation to the self employed in 1999. However, accident rates fell significantly less among the sub-set of low risk self employed affected by the legislative amendments in 2015 relative to high risk self-employed workers.

2. Health and Safety Legislation in Great Britain

Occupational safety legislation in the UK is a complex patchwork dating back to the 1833 Factory Act, which led the way for inspectors to monitor the dangers of textile mills. In more modern times, the 1974 Health and Safety at Work Act established the HSE to develop strategy on improving occupational safety, to bear responsibility for information provision, to conduct

workplace inspections, enforce safety regulations, alongside collection of data on accidents, illnesses and deaths arising from work.

Self-employed workers with employees were obligated to observe health and safety regulations when the 1974 legislation was enacted. In 1980, the duty to report accidents, illnesses and fatalities relating to their business was extended to the own account self-employed. The 1999 Management of Health and Safety at Work Act required own account self-employed to go beyond conducting risk assessments of the potential impact of their activities on themselves and any others put at risk by their work in line with employers, as introduced from 1992. Own account self-employed workers had to seek to prevent or reduce hazards associated with their occupation, as far as was reasonably practicable. This was the final step in fully incorporating the self-employed into the occupational safety regulatory framework. As was the case with most workplace safety regulation and more general employment protections introduced in the UK in the 1990s, this change arose from the need to comply with European Union Directives (HSE 2001, Lofstedt 2011).

2.1 The (Partial) Deregulation of Self Employment

In 2010 a British government advisor, Lord Young, was invited to review the British system of workplace health and safety with a brief to explore what the government of the time saw as the “over-zealous” (2010: p7) application of health and safety regulations. In striving “to free businesses from unnecessary bureaucratic burdens and the fear of having to pay out unjustified damages claims and legal fees” (2010: p9), Young called for simplified risk assessments where accident risk was low, advocating the removal of this duty for self-employed workers in low-risk businesses.

The British Government commissioned an academic, Lofstedt (2011), to explore the implementation of this recommendation, with a remit to reduce “the burden of health and safety regulation on business, whilst maintaining the progress that has been made in health and safety

outcomes” (2011: p9). He offered four recommendations: to simplify legislation and related guidance; to limit the exposure of firms to legal action from employees; to transfer responsibility for all safety-related inspections from local government to the HSE, with a view to focusing activity on high-risk business; and to exempt those self employed in low-risk industries from protective legislation.

The Lofstedt review called for further work in order to identify the “high-risk” sectors. The HSE (2013) Impact Assessment of this proposal identified the sectors to classify as “high-risk”.² The “high-risk” sectors to remain covered were: agriculture, mining and quarrying, construction, nuclear installations, offshore extraction activities, rail, gas fitting and installation, driving, control of major accident hazard sites, genetically modified organisms (gmo) and explosives. By default, rather than as a result of empirical investigation, the residual became labelled the “low-risk” sectors. All agency workers, whether employed or self employed, and any self-employed individuals (for example, company directors) with employees remained subject to the health and safety framework. The HSE estimated that some 840,000 self-employed workers “whose workplace activities pose no potential risk of harm to others”. “in low-risk industries” would be exempted.³ In practice, this meant they no longer had to adhere to legislative protection on issues such as the management of work equipment, control of noise at work or lifting of equipment and would be free of inspection and investigation.

This proposal was widely criticised at the time, see for example Bibbings (2013), Tombs and Whyte (2013), and TUC (2011). Bibbings (2013) argued that the proposals reflected approaches used in other EU countries rather than considering what was suitable for

² All UK government policy proposals are subject to an Impact Assessment of the potential costs and benefits of the policy before the law is passed. These are carried out by the government agency or department closest to the policy.

³ The legislation applied only to Britain not Northern Ireland, which has a separate Health and Safety Agency. Northern Ireland is excluded from the analysis.

Great Britain.⁴ The All Party Parliamentary Group on Occupational Safety and Health (c.2013) also voiced concerns about the possible consequences for work-related health of exempting certain sectors from legislation. James, Tombs and Whyte (2013) criticised the discussion of “risk” in both of the government-sponsored reviews and in the Impact Assessment and argued that the evidence used by Lofstedt was dominated by pro-deregulation business stakeholders and extant government agency reports rather than newly commissioned empirical research. Despite this criticism, the government went ahead and the proposal to exempt low-risk, self-employed individuals was passed in 2014 and became law in October 2015.

2.2 Self Employment and Occupational Accidents

There is little literature on the effect of regulatory changes on the accident rates of self-employed workers. Regarding compositional effects, Tatomir (2015) suggested that workers may be drawn to a flexible career, which might bring greater financial prosperity, or they may be compelled to set up independently by a lack of other employment opportunities.⁵ If either of these are associated with greater acceptance of risk, growth in self employment may be associated with greater incidence of accidents. Tomlinson and Corlett (2017) show that the recent growth in UK self employment has been concentrated in advertising, public administration and banking, which on the surface we might anticipate to be less accident-related than longer established self-employment occupations such as taxi driving, electricians, plumbing or construction.

⁴ There is no pan-EU agency concerned with workplace safety. There is national variation in whether EU workplace directives (eg on working hours) are extended to self-employed workers (Targoutzidis and Karakoltsidis: 2009). Sweden applies health and safety rules to the self employed in the chemical and machinery sectors; Germany applies them to those self employed whose activities may affect others; occupational legislation in Ireland applies to employed and self-employed workers alike. In the United States, the self-employed are exempt from OSHA legislation.

⁵ See also Bögenhold and Klinglmair (2017) for Austria.

Risks may also change within a given sector over time. Eurostat (2018) highlights that the only sectors with increasing accident rates across the EU between 2010 and 2015 were public administration, and health and social work; human health had the third highest rate of non-fatal accidents jointly with construction. Any growth in the self employed share within more risky occupations would affect relative accident rates.

Institutional incentives favouring the contracting out of non-core service by employers now increasingly pertain in Britain. Consistent with this finding, the largest growth among the self employed in the UK over the sample period is of “directors”.⁶ If these workers are entrepreneurial in outlook then we might anticipate a greater willingness to take risks than amongst employees, which may then be associated with variation in accident rates by contractual status.

Self employment may bring with it a transfer of risk from the organisation to the individual (James, Johnstone, Quinlan and Walters, 2007; Targoutzidis and Karakoltsidi 2009) and various studies of sub-contracted labour have identified their vulnerability and greater occupational accident risk, see Sinclair and Haines (1992), Mayhew, Quinlan and Bennett (1996) for Australia, Wokutch (1992) for Japan and Nichols (1986) for UK.⁷ Both James (1993) and Mayhew and Quinlan (2006) found high rates of accident and a greater risk of poor health amongst self-employed Australian drivers. Nichols (1997) finds variation in “minor” injury rates, but similar “major” injury rates for employed and self-employed workers in the UK using a self-assembled data set. He stressed that the “core-periphery” model of the labour market may influence accident rates, which remains relevant given the rise in fissured

⁶ The designation “a director” means that an individual is exempt from income tax but responsible for corporation tax. Any divergence in these two tax rates may create incentives to adopt and claim the most tax efficient status. Moves to contract out non-core business could also raise the incidence of directorships. A reclassification from employee to self-employed status removes the necessity of employers to pay National Insurance, holiday or sick pay. See the court cases taken by workers against Uber and Deliveroo for example (Butler 2018).

⁷ Eurostat (2018) cautions that there is likely to be under reporting of workplace accidents in countries which offer state social security, compared to insurance-based compensation systems where reporting is essential for a payout. This may impact the usefulness of international comparisons.

organisations, Weill (2014), Rubery, Grimshaw, Keizer and Johnson (2018).⁸ Simpson, Wadsworth, Moss and Smith (2005) reported that minor accident rates (those not requiring medical attention) were higher for self-employed workers in Wales than for employees. In contrast, Zwerling et al (1996) examined the accident rates of older workers in the US in the early 1990s and found the self employed less likely to report injuries than employees.

The self employed are generally not trade union members. Around 5% of the self employed are union members in our data set, so they lack access to the collective voice effects which may help to identify risks (Fenn and Ashby 2004) or work towards risk reduction (Donado and Walde 2012). The latter argued that it would never be in the interests of firms or the government to ensure the optimal level of health and safety, so independent institutions are needed to provide information and enforce standards across all categories of workers⁹. Indeed, the All Party Parliamentary Group on Occupational Safety and Health (2013) reported that 90% of organisations inspected by the HSE found it helpful. In contrast, Shapiro (1999) reported that safety inspections in the USA had very little or negligible impact. As the self employed will be less likely than organisations to have in-house occupational safety expertise, the withdrawal of coverage by HSE leaves them lacking safety advice and information.

The economics literature is largely silent on the interaction between self employment , institutions and non-fatal accidents. There is a long-established economic discourse that looks at the link between the enforcement of institutional legislation and workplace accidents, that does not differentiate by employment status (for example, Viscusi 1986, 2007, Gray and Mendeloff 2005, Pouliakas and Theodossiou, 2013).

⁸ See for example, the continuing incentives to contract out to agency labour in particular industries and the phenomenon of “the fiction of self employment” associated with couriers in the UK (Moore and Newsome 2018, p476) and construction workers (Behling and Harvey 2015).

⁹ Stricter employment protection legislation across the EU has had the effect of reducing the rate of non-fatal accidents in the workplace (Radelescu and Robson 2018), though the authors do not distinguish between self-employed and employed workers or explore any disaggregation of workers.

Using a hedonic matching framework (Viscusi, Magat and Huber 1987), the existence of health and safety legislation can internalise the externalities that follow from the failure to evaluate the true extent of occupational risk. Exempting some of the workforce from legislation, could unleash externalities that may lead to a greater exposure to risk. If there are information frictions, then the removal of a source of advice (here the HSE) could impede informed behaviour and increase accidents. Removal of restrictions might also encourage risk lovers into this activity and raise accident rates.

Conversely, proponents of the law change could argue that government intervention to address market failure itself requires information to work effectively, in order to balance risk reduction against cost with the aim of maximising social welfare. If the legislation was too blunt to address market failure in health and safety provision, it could be argued that partial repeal may move the economy toward a more market efficient equilibrium.

In this context, if the self employed were to become more risk accepting or the nature of the work undertaken by self employed workers became more risky, this would work to raise the relative accident rate. The literature on risk preferences by employment status suggests that the self employed have greater risk acceptance – as measured by attitudes to financial risk, see for example Ekelund, Johansson, Jarvelin, and Lichtermanne (2005) for Finland; Colombier, Denant Boemont, Lohéac and Masclet (2008) for France; Brown, Dietrich, Ortiz-Nuñez and Taylor (2011) for the US. There seems to be little evidence on the role of risk attitudes towards occupational safety. A study of working conditions throughout the EU, (Leoni 2010), found that the self employed reported a significantly greater perception of occupational risks at the workplace than employees – though the focus here was perceptual risk rather than on incidents at work.

3. Methodology

The differential pattern of accidents and the factors influencing the divergence of non-fatal accident rates by self employed status are matters crying out for empirical verification.

3.1 Data.

To investigate we need an individual-level data set which records non-fatal accidents, workplace sector and self employed status over time. The UK Labour Force Survey, (LFS) is a stratified random sample of around 40,000 UK households undertaken in each quarter, commissioned by the HSE since 1993 to include questions on (non-fatal) workplace accidents. The sample window stops in 2019, after which the COVID pandemic interferes with sampling response rates in the LFS.

Using accident data from a household survey has certain advantages. An employer-based recording system will suffer if employees are reluctant to report incidents fearing dismissal. Equally, if sick pay is not available they may prefer not to report and work through their injury (Arocena and Nunez, 2009). Small businesses and the self employed may be less aware of the need to take steps to improve workplace safety and /or lack the capacity to monitor workplace safety. Employers and self employed workers may choose not to report incidents to a government agency if they are fearful of inspection and prosecution (Young, 2010; Lofstedt, 2011). We cannot discount the possibility of measurement error in the LFS accident data, but this is more likely to increase the imprecision of the estimates rather than bias them, since the measurement error will be on the dependent variable.

The question with regards to workplace accidents proffered to all individuals in work, and those not in work who have been employed within the last year, is:

“Thinking of the twelve months since [full date], have you had any accident resulting in injury at work or in the course of your work?”

The low frequency of accidents means that there are between 650 and 800 accidents recorded in the LFS sample in any year, one sixth of which involve the self employed. Individuals are also asked what type of accidents they had and the number of days off work as a result of any accident. The degree of non-response to the conditional question of duration of any accident absence is rather large, at around 30%. The mean number of days off sick as a result of an accident is rather volatile over time, ranging between 10 and 21 days, (see Table A1). This in part reflects the low frequency of accidents in the population. Small changes in the number of reported accidents can lead to large changes in reported absence durations. Most accidents seem to involve a return to work in under a month and less than 1 per cent of accidents in the UK lead to a spell off work lasting more than 6 months. The most typical type of accident is a “sprain”, followed by bruising and lacerations. This ranking does not vary much between high and low risk occupations, (Table A2).¹⁰

The LFS classifies the self employed into those with employees and “own account” workers with no employees.¹¹ Self-employed workers with employees are required to administer Health & Safety legislation for their workforce, so their actions will have direct implications for all. Any spillover effects could compromise the difference analysis used below, so a focus on own account workers should lessen this risk.

The LFS contains a large number of socio-demographic and workplace characteristics to try to net out any observed differences in the composition of the self employed, or employees, and their occupations that may drive differences in accidents rates, independent of any deregulatory impact. Alongside controls for age, education, gender and ethnicity, variables likely correlated with risk attitudes, notably religion, marital and immigrant status, housing

¹⁰ The low frequency of accidents in the sample means the sample size should be large enough to detect low frequency events. Power calculations – available from the authors on request - suggest that a yearly sample size above 10,000 is large enough to detect an effect size of around 0.01.

¹¹ The OECD (2018b) categorises “own account” self-employed in the LFS as “solo” self-employed workers. Domestic workers in private households have been exempt since the original 1974 Health and Safety at Work Act. Since this group is less than 1% of the total UK workforce, they are excluded from our analysis.

tenure and number of dependent children are generated.¹² There are controls likely associated with the riskiness of the job, including total hours worked and length of period in the current occupation (tenure), weekend working, second job holding and whether the individual lives and work in the same local authority, (as a proxy for commuting). There are also sets of one digit occupation and industry dummies to try to net out any sector variation in workplace risks. Workers in Scotland are covered by a different Health and Safety Executive but were subject to the same legislative changes as England and Wales, so a dummy variable for living in Scotland is included. Dummy variables for missing values on covariates by sample respondents are included to maintain sample sizes. The available set of control variables is somewhat larger in the second sample period than the first. It could be argued that some of these controls are influenced by the experience of an accident and so are endogenous in any regression. We test the sensitivity of the results to the inclusion of different sets of controls in what follows.

3.2 Estimation Strategy.

A simple difference-in-differences framework is used for the analysis, with the 2015 change explored using triple differences estimation. Models of this type attempt to measure the causal effect of a policy intervention by looking for a change in the behaviour of the affected group compared with the behaviour of a control group, (Wing, Simon, Bello-Gomez 2018). The assumptions underpinning difference-in-differences models may fail if the behaviour of treatment or control groups change in anticipation of the policy change. This may be more likely where there is a delay between announcement and enactment. Multiple pre-treatment years of data allow tests of the parallel trends assumption to identify any potential anticipatory effects.

The following simple multi-period differencing model is estimated

$$\text{Accident}_{it} = \beta_0 + \beta_1 t + \beta_2 t \text{Treated}^* + X_{it} B_4 + u_{it} \quad (1)$$

¹² There are no personality measures in the LFS such as those used by, for example, Blanchflower and Oswald (1998) in their study of the determinants of self-employment.

where X_{it} are individual and job specific control variables outlined above and u is a normally distributed error term. The coefficients on the time period dummies, β_t , capture changes in accidents for the control group over time relative to the base year in which the policy was introduced. The coefficients of interest, β_{3t} , on the interaction of the treatment dummy with the year dummies gives the difference-in-differences estimate of the policy change. Any significant effects on the interaction terms for the periods after the policy suggest a change in behaviour for the treatment group relative to the control. The dependent variable is binary but the estimation is OLS which remains consistent but inefficient.¹³ The sample window is three years before and four years after the legislation.

The treatment group in 1999 is all own account self-employed workers. In 2015 the treatment group is the sub-set of own account self-employed workers in the low-risk sector exempted from health and safety legislation. The second group – the control - is not exposed to the treatment in either period. For 1999 the control is all employees, since they were already covered by legislation.

The 2015 legislation fits unusually into the treatment methodology, since it removed a group of individuals previously covered. Those taken *out* of legislation are therefore treated. The control group comprises own account self employed workers *who remained* covered by Health & Safety laws. The LFS contains information on the sector (industry and occupation) in which an individual works. Sectors designated by the Impact Assessment to be high-risk (HSE 2013) who were to remain covered by the law. These were agriculture, mining and quarrying, construction, nuclear installations, offshore activities, rail, gas fitting and installation, driving, control of major accidents hazard sites, explosives and genetic modification working outlined by the legislation.¹⁴ The data set contains identifiers for agency

¹³ See Hole and Ratcliffe (2019) for a discussion of the issues estimating difference-in-difference effects using probit estimation.

¹⁴ See the HSE website for a list of “high risk” sectors <http://www.hse.gov.uk/self-employed/what-the-law-says.htm>

work and the self employed with employees; both groups remained covered by HSE legislation. Together these “high risk” groups comprise the “control” section of workers.

For the remainder, those self-employed workers who do not fall within these categories, the situation is somewhat more complex. The legislation left it to workers outside these high risk sectors to assess whether their activity might impact the safety of themselves and others, and therefore to categorise themselves as high or low risk and take appropriate action accordingly. For example, hair colourists do not fall within the sectors designated as high risk in the legislation but they may clearly impact the health and safety of themselves and others through their use of chemicals. This ambiguity is likely to lead to variations in risk identification across self-employed workers in these other sectors.

Faced with “fuzzy” classification into treated and non-treated groups, one option is to generate a control group that is unlikely to experience spillover effects, (see Chaisemartin & D’haultfœuille (2018), Clark, Senik and Yamada (2017)). A set of self-employed in occupations with high historical accident rates but not designated high risk in the legislation are excluded from the treatment (and control) groups. The robustness of the results to the definitions of high and low risk is tested below.

One of the requirements of difference in difference analysis is that the characteristics of treatment and control remain stable over time. Identification of any treatment effect is compromised if the composition of the treatment and control groups changes as a result of the intervention. Summary statistics for the confounding variables used in the analysis, by self-employment status, before and after the 2015 legislation are detailed in Table A1. While there are obvious differences in the composition of the high and low risk groups, it is less obvious that there are many significant large scale movements in sample characteristics, that could shift accident rates.

Using high-risk self-employed workers as a control may not allow for other factors that might differentially affect the low-risk or high-risk sectors of employment *not* related to health and safety legislation, a relative increase in aggregate demand for low-risk jobs for example commensurate with rising accidents in low risk jobs. An alternative would be to use employees working in the low-risk sector as the control group. The problem with this alternative classification is that changes in accidents between the self employed and employees in the low-risk sector may be due to trend variations in behaviour or attributes between employees and self employed in the low-risk sector and not the policy change. It might be argued that there is something inherently different in the conditions faced which makes low risk employees a poor comparator group for low risk self-employed workers.

An arguably more robust test of the 2015 legislation's effects is to use both groups (employees in low-risk and self employed workers in high-risk) as controls, using changes in accidents between employees in high and low-risk sectors to net out any effects from working in the high and low-risk sectors. This can be facilitated by triple differences estimation:

$$Y_{it} = \beta_0 + \beta_1 \text{Low} + \beta_2 \text{Self} + \beta_3 \text{Low} * \text{Self} + \beta_4 \text{After} + \beta_5 \text{After} * \text{Self} + \beta_6 \text{After} * \text{Low} + \beta_7 \text{After} * \text{Low} * \text{Self} + X_{it} B_8 + u_{it} \quad (2)$$

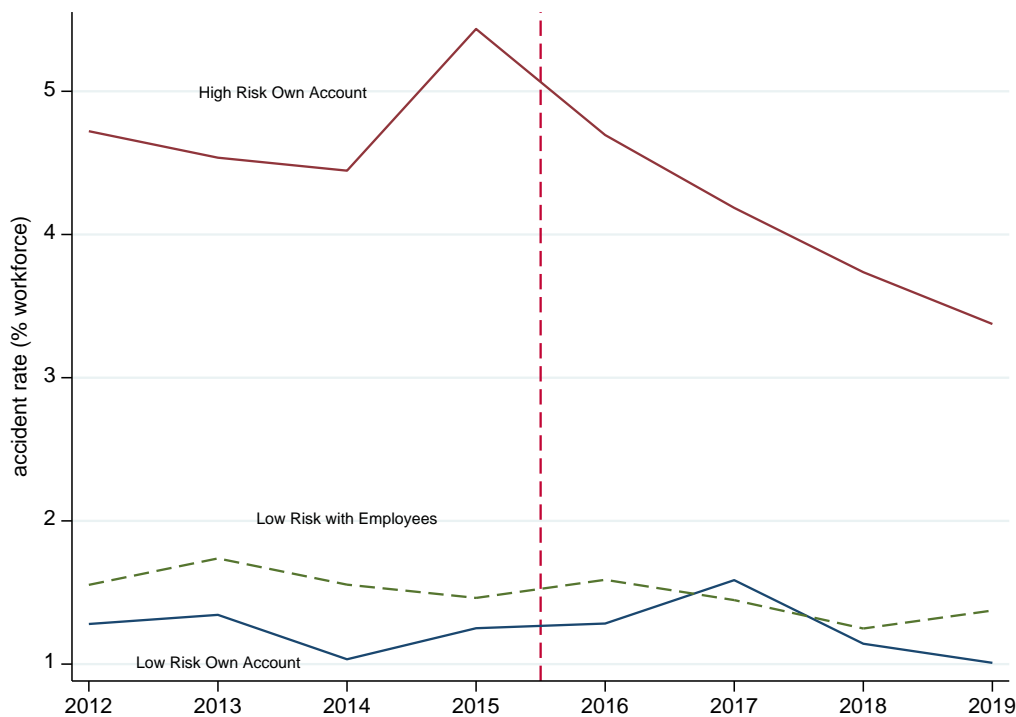
The coefficient of interest is now β_7 , the coefficient on the triple interaction term, the mean change in accident rates of self employed working in the low-risk sector net of a) the change among other self-employed workers *and* b) net of changes among employees working in the low-risk sector:

$$\beta_7 = \left(\overline{\text{Accidents}}_{self_low_t1} - \overline{\text{Accidents}}_{self_low_t0} \right) - \left(\overline{\text{Accidents}}_{self_high_t1} - \overline{\text{Accidents}}_{self_high_t0} \right) - \left(\overline{\text{Accidents}}_{emp_low_t1} - \overline{\text{Accidents}}_{emp_low_t0} \right) \quad (4)$$

4. Results

Accident rates among the “high-risk” self employed are greater than among the “low-risk” self employed group. The mean accident rate for “high risk” self-employed own account workers is around 3 times that of “low risk” self-employed workers, (see Figure 2 and Table A1 in the appendix). However, in recent years, rates have converged across the self employed groups, being broadly stable among the “low-risk” self employed and falling among high-risk self employed still covered by the legislation. Accident rates among the excluded groups used in the sample construction, (not shown), lie between the low and high risk groups. Broadly stable rising accident rates in this period are also observed among employees working in the same “low-risk” sectors.

Figure 2. Workplace Accidents: Self Employed by Risk Status: 2012-2019



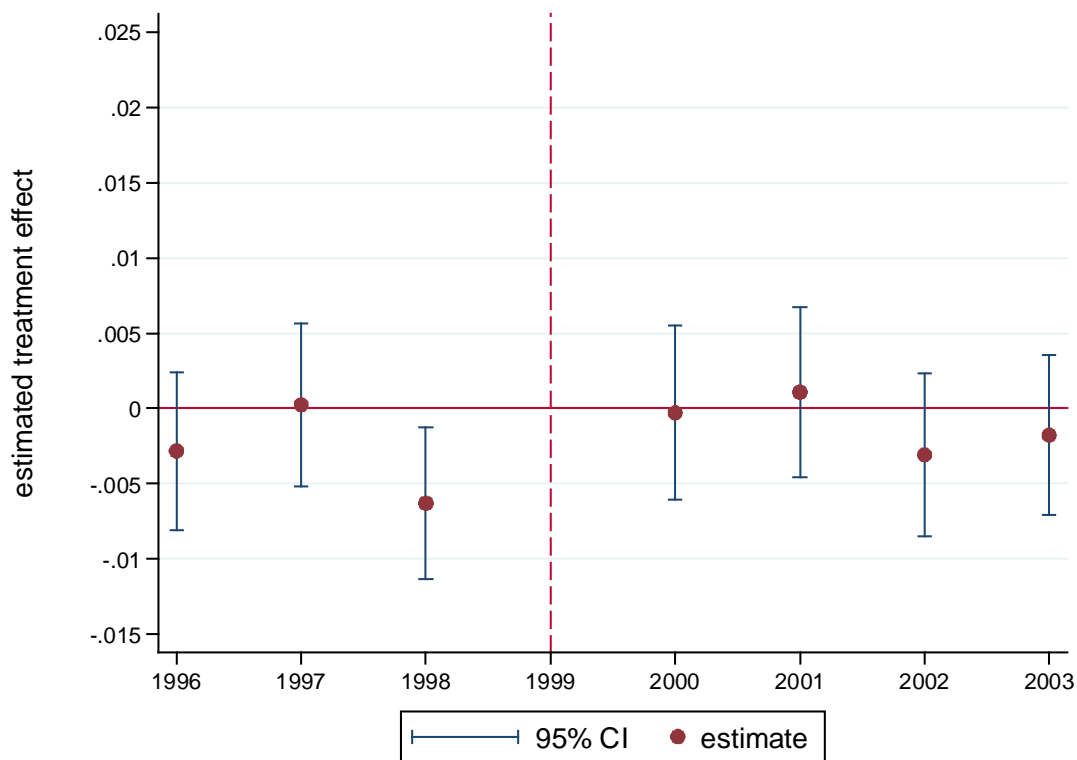
Source: LFS author calculations.

4.1 The Impact of Increased Regulation

Accident rates for own account self employed and employees fell between 1996 and 2003. If legislation had an impact some change in the relative behaviour of the own account self employed would be expected *after* the extension of safety regulation.

Figure 3 graphs the difference-in-differences coefficient estimates based on equation (1), the interaction of the self employed dummy with each individual year dummies between 1996 and 2003, along with the 95% confidence interval associated with the point estimates. If the confidence interval lies wholly above or below the horizontal line at zero in any period, this is indicative of significant differences in the change in accident rates between the two groups. If the confidence intervals straddle zero, accident rates are changing at the same rate for the two groups. If the confidence intervals lie above zero then the accident rate for the low risk self employed are either growing faster or falling at slower rate than the comparator group.

Figure 3. Difference Estimates: Own Account Self-Employed v Employees 1996-2003



Source: LFS authors' calculations. The vertical line on the graph indicates when the legislation became law.

Graphing estimates in the years before the policy intervention should help establish the presence of any diverging pre-treatment trends that might compromise the estimation process. Since the sample window covers multiple years, we present difference estimates that pool the multiple before and after years into two groups alongside difference estimates that allow separate year-by-treatment interactions over the sample window, (see Table 1).

The results, show little evidence of a differential rate of accidents between the self employed and employees before the change in legislation or after. The addition of demographic and workplace controls strengthens the findings of a slower relative decline in accident rates among the self employed after 1999, but also strengthens the findings of a slower relative decline before 1999. Consequently, it is hard to attribute any of these observed changes to the 1999 legislation.¹⁵

4.2 The Impact of Partial Deregulation

To show the effects on relative accident rates in the periods up to and beyond the partial repeal of legislation, Figure 4 graphs the point estimates on the difference-in-difference terms for 2012 until 2019, along with the 95% confidence intervals.¹⁶ Workers may have anticipated the policy change and accident rates may have shifted before deregulation was enacted. This should be reflected in relative variation in accident rates between the two groups before 2015.

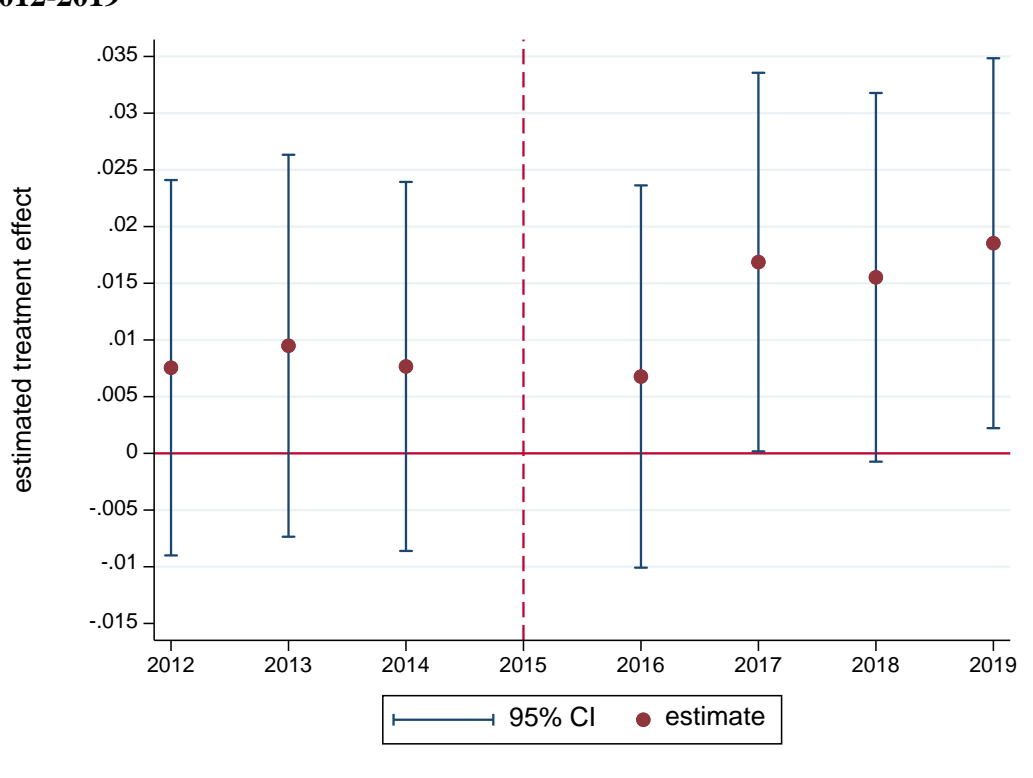
The pattern of the estimates suggests that accidents among the “low risk” own account self employed appear to have risen relative to the “high risk” comparator group after the legislation was enacted. Positive differentials can also be seen before the legislative change, but this pattern is relatively stable and not statistically significant in the “pre-treatment” period. In practice, Figure 2 suggests that accident rates converged because accident rates among the

¹⁵ The lack of significance between own account self employed others holds if the control group of employees is restricted to sectors in which the self employed are concentrated and if the sample is based on propensity score balancing of the predicted probability of being an own account worker and if the control sample is other self employed workers.

¹⁶ The literature is agnostic about methods of inference in a difference-in-differences model with two groups. See Brewer, Crossley and Joyce, (2018), for example, for a discussion.

“high risk” self employed fell after the repeal while the rate for those freed from legislation declined less. These results are little changed by addition of the, arguably exogenous, demographic and job controls, (Table 2, columns 1 to 3). Combining the individual year interactions as a single “after treatment” effect, indicates that the relative accident rate for “low risk” self-employed workers grew by around 0.8 percentage points after the legislation was enacted, (Table 2 columns 4 to 6).

Figure 4. Difference Estimates: Low Risk Self-Employed v High Risk Self-Employed 2012-2019



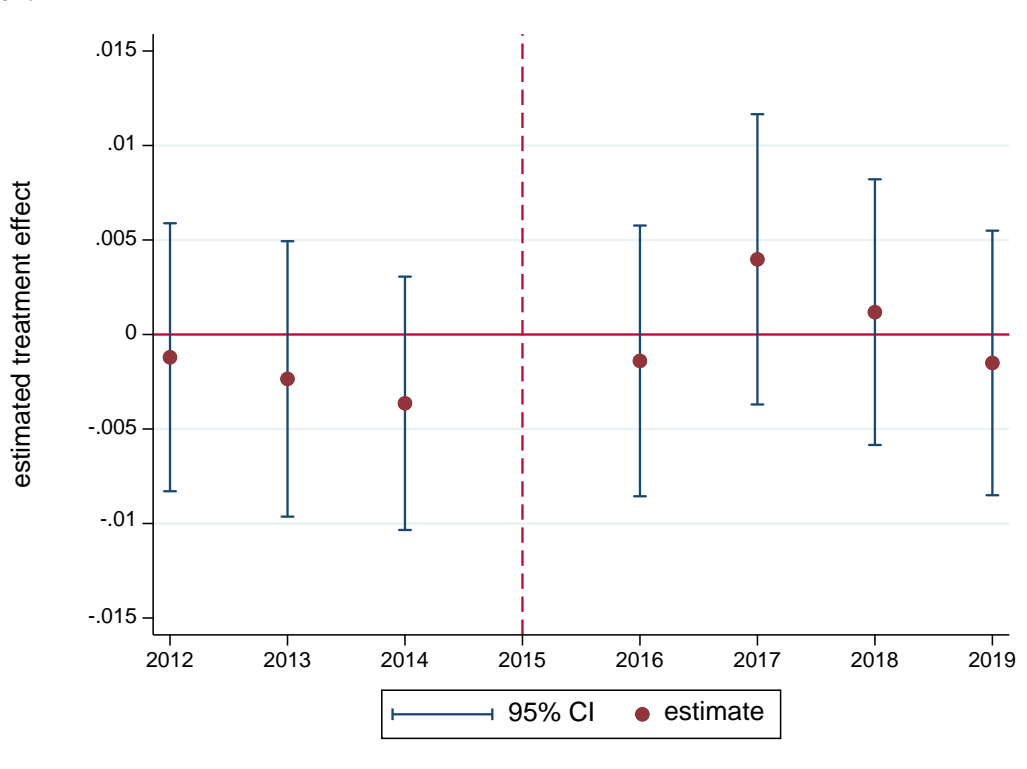
Source: LFS authors’ calculations. The vertical line on the graph indicates when the legislation became law.

The estimated effects of the confounding variables are given in Table A3. They broadly conform to findings from the existing accident literature; men, individuals with fewer formal qualifications and manual workers are all at greater risk of a non-fatal accident at work. Replacing accident incidence with the number of days off work (Table A4), suggests that the

effect of the legislation is around one half day extra absence among the “low risk” solo self employed.¹⁷

Figure 5 graphs the difference-in-differences estimates using an alternative control group, “low risk” employees. Table 3 gives the estimates for this regression. The 2017 point estimate is different from the pre-deregulatory estimates but fails to reach statistical significance. Relative rates after 2017 remain (insignificantly) positive, with no discernible trend.¹⁸ The results that underlie the Figure are given in Table A5 of the appendix.

Figure 5. Difference Estimates: Low Risk Self-Employed v Low Risk Employees 2012-2019



4.3 Robustness Checks

To demonstrate that the change in accident rates is related to the enactment of the 2015 legislation, Table 4 reports results for a placebo time window, imposing a break in the data in

¹⁷ Using days off rather than a binary variable for accident experience conflates both the incidence and intensity of any effect since those with no accidents are recorded as zero days absence in the dependent variable.

¹⁸ An alternative control sample restricting “low risk” sector employees to those in small firms (<25 employees), which may typically lack capacity to manage risks in the working environment (All Party Parliamentary Group on Occupational Safety and Health 2013), was also used. The results are little changed.

2012 when no legislation was enacted. The estimates show that no “after treatment” effect exists in the placebo sample window.

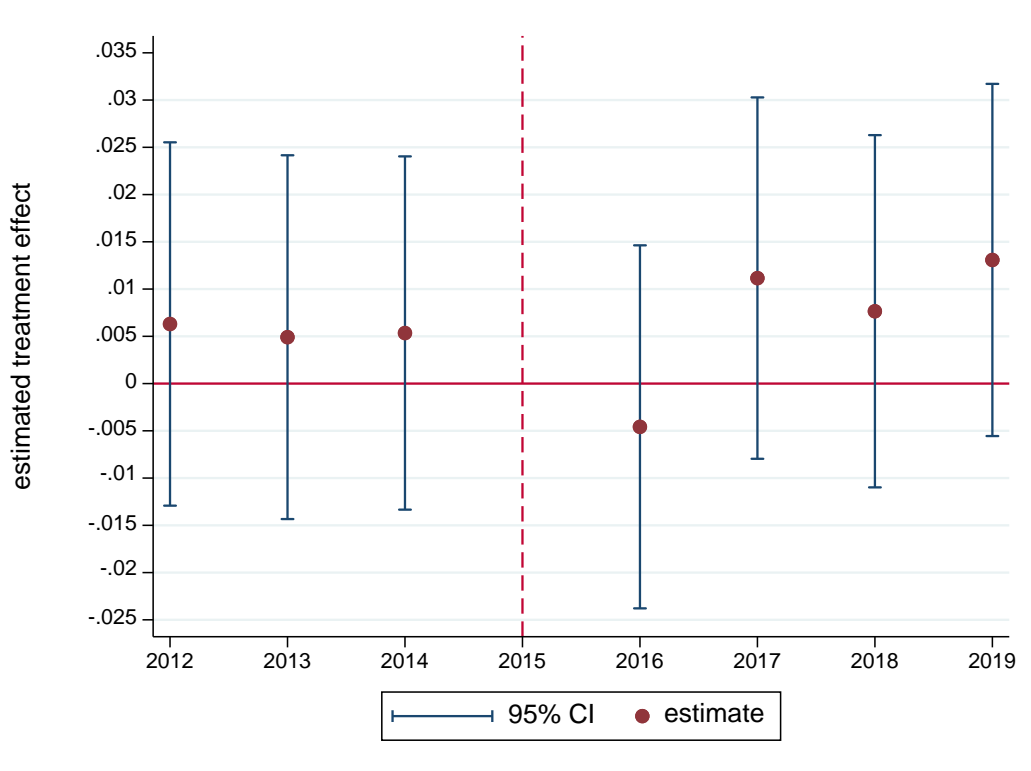
Low risk self employed workers are more likely to be female and employed in non-manual occupations than the high risk group. While regression controls should net these differences out, an alternative approach is to align the treatment and control group samples more closely. In Table 5, the sample is split by gender and manual/non-manual occupations and the difference in differences model estimated on these sub-samples. The increases in relative accident rates for the low risk self employed after 2015 are much stronger and statistically significant for men and in particular manual occupations.

To address the ambiguity over which groups were covered by legislation, Table A6 in the appendix examines whether the results are sensitive to the set of occupations included in the high risk control group. The construction industry remains covered by safety legislation but the control group is broadened to include electricians and metal workers not employed in the construction industry. The results, if anything, are even more suggestive that accident rates between high risk and low risk self employed groups moved differentially after 2015.

To help determine whether the observed shift in relative accident rates stems from changes in the behaviour of the treated group, the triple differences estimates of equation (2) are graphed in Figure 6.¹⁹ The results show that before deregulation relative accident rates were stable. After 2015 relative accident rates do not shift significantly. This implies that the diverging accident rates observed in Figure 2 and Table 2 may not be caused by changed behaviour among the treated population of low risk solo self-employed workers.

¹⁹ The results that underlie the Figure are in Table A7. The estimates for the controls are available from the authors on request.

Figure 6. Triple Difference: Low Risk Self-Employed v. High Risk Self-Employed v. Low Risk Employees



To explore this further, Table A8 in the appendix reports results from an alternative test; a difference in difference estimate of the change in accident rates on high risk own account self employed against high risk employees over the same period. Neither of these groups are subject to legislative change, but the results (columns 1 and 2) indicate that accidents among both high risk self employed *and* high risk employees fell more rapidly after 2015. A separate difference regression comparing accident rate changes for high risk and low risk employees, (columns 3 and 4) confirms that accident rates only fell for high risk employees after 2015. Taken together, (shown also in Figure 2), accident rates fell more across the high risk sector after 2015 than in the low risk sector.

5. Discussion

The 1999 increase in regulatory coverage on the self employed appears to have had little effect on the relative incidence of non-fatal accidents. It may be that the self employed were already engaging in “common sense practice” such as undertaking risk assessments and reducing

workplace hazards, which would make such legislative extension unnecessary. Alternatively, it may be that the self employed were ignorant of, or oblivious to, this responsibility. Vickers, James, Smallbone and Baldock (2005) found safety inspection and enforcement was lower in UK micro firms (with fewer than 5 employees) than in small firms.

In contrast, the 2015 deregulation was followed by a significant convergence in the accident rates of those made exempt from occupational safety regulation and those self employed workers who continued to be covered by the legislation. Accidents among both high risk self employed *and* high risk employees fell more rapidly after 2015 than rates for low risk self employed.

One caveat to these findings stems from the possible consequences of exemption on accident reporting. Jhang (2018) looked at the impact of occupational safety deregulation in South Korea from 1998 onwards. It was predicted that withdrawing protection would merely affect information provision, but Jhang found that it led to under-reporting of industrial accidents. This may suggest that our results are a lower bound on actual accident rates among the low risk self employed who were exempted from legislation. If differential reporting rates between the low risk and high risk self employed did change after 2015, this would work to reduce any observed differences between the two groups.

The All-Party Parliamentary Group (2013) argued that exempt self-employed workers would have less capacity to keep up-to-date with safety advancements. Given the ambiguity of those covered by the 2015 reform, policy makers might need to be more explicit at their definitions of “high risk” and “low risk” sectors if sectoral exemptions were to continue to be mandated. Bibbings (2013) and OECD (2018b) argued that any selective application of health and safety regulations would cause confusion, potentially resulting in the circumvention of safety rules in pursuit of competitive advantage, leading to greater infringement in covered

sectors too. The estimates above explicitly address the issue of spillovers by removing an intermediate group from the analysis.

Any convergence in accidents might appear a surprising outcome given the apparent weaknesses in the UK workplace safety system at that time. Many have catalogued the cuts to HSE funding in the years before deregulation (Wadsworth and Walters 2014, Tombs and Whyte 2013), number of inspectors (James, Tombs and Whyte (2013), Tombs and Whyte 2013), HSE (James and Walters 2019) and local government safety inspections (Tombs 2016) and enforcement (Moretta et al 2021, Tombs 2017). Moretta, Whyte and O’Neill (2021) report a drop of more than 50% in prosecutions for health and safety offences between 1999 and 2019, with an even more dramatic fall in local authority inspections due to resource constraints (James and Walters, 2019; Wadsworth and Walters, 2014). The UK government claimed, in a report to the European Committee of Social Rights in 2017 discussed by Moretta et al (2021), that this targeting of resources on high risk sectors was their intent. This is consistent with our findings above.

6. Conclusions

The UK has enjoyed a long-term improvement in both fatal and non-fatal accidents at work. These trends have not prevented the ongoing vilification of Britain’s health and safety system from parts of the media and some politicians. In 2012, the then Prime Minister, David Cameron, decried the health and safety framework, describing it as an “albatross around the neck of British businesses” (reported in Woodcock, Bentley and Glaze 2012). Despite this view, the OECD (2018b) reported that UK employment protections were amongst the weakest in the developed world. This paper examines the impact on non-fatal workplace accidents of both extending and retracting regulatory coverage from self-employed British workers. This is the

first paper – to our knowledge – that has explored the links between occupational safety legislation, non-fatal accident rates and self employment in detail.

In 1999, legislation was passed to fully incorporate the self employed within this system, giving them a duty to perform risk assessments and undertake hazard reduction. Utilising a difference-in-differences framework to explore the impact of this and the subsequent policy change, suggests that this change had no significant impact on the relative accident rate of solo self-employed workers, compared with employees.

In contrast, almost fifteen years later, the British government exempted self-employed workers in designated “low risk” sectors from health and safety legislation and any prospect of inspections and punishment by the HSE. It was argued that regulatory removal would save some self-employed workers from unnecessary red tape without adding to the rate of occupational accidents. However, our results suggest that something did change after the 2015 repeal, something unexpected. The estimates indicate that the rate of accident improvements among “low risk” self-employed workers have been slower than among the self employed who remain covered by the legislation. Prior to the reform, non-fatal accident rates for the “high risk” self-employed group averaged 4.5% of the group , falling to 4% after the reform, while accident rates for ”low risk” self-employed workers stayed broadly constant at around 1.25% . The regression estimates indicate that this differential in accident rates narrowed by around 0.8% points.

Occupational health and safety is an important issue for workers and the wider economy. Even in an economy where accident rates overall are improving, the cost of occupational accidents to workers and society more widely is substantial, Mazzolini (2020). Pouliakas and Theodossiou (2013) called for greater research into workplace safety as workforces and occupations become more heterogeneous, with their survey highlighting the limitations inherent in relying upon market-based systems of occupational safety regulation.

The OECD (2018a, 2018b) recommends that health and safety legislation be clarified and monitoring improved in the face of new forms of working including solo self employment.

The subsequent departure of the UK from the European Union, offering with it potentially greater freedom to repeal occupational safety regulations (Foster and Parker, 2021), may mean the 2015 change analysed here is but a first stage ahead of a period of deregulation. It is certainly the case that fruitful study is needed of the patterns and causes of occupational ill health beyond accidents at work. It may be that the importance of health and safety, and of experts, during the Covid pandemic will lead to a “rehabilitation” of occupational safety regulations. It is, as yet, a little too early to say.

Table 1. Estimates of 1999 Legislation Effects on Accident Rates: Own Account v Employees

	(1)	(2)	(3)	(4)	(5)	(6)
Own Account*1996	-0.0063 (0.0040)	-0.0087** (0.0040)	-0.0111*** (0.0039)			
Own Account*1997	-0.0034 (0.0040)	-0.0043 (0.0040)	-0.0054 (0.0040)			
Own Account*1998	-0.0099** (0.0039)	-0.0100** (0.0039)	-0.0114*** (0.0038)			
Own Account*2000	-0.0038 (0.0042)	-0.0040 (0.0042)	-0.0058 (0.0041)			
Own Account*2001	-0.0032 (0.0041)	-0.0044 (0.0041)	-0.0076* (0.0040)			
Own Account*2002	-0.0067 (0.0040)	-0.0070* (0.0040)	-0.0103*** (0.0040)			
Own Account*2003	-0.0054 (0.0040)	-0.0067* (0.0040)	-0.0117*** (0.0038)			
OwnAccount*After1999				-0.0027 (0.0019)	-0.0013 (0.0019)	-0.0032* (0.0019)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes

Source: UK Labour Force Survey (LFS). Robust standard errors in brackets. Personal controls include dummy variables for age, gender, qualifications, marital status, ethnicity, presence of children, housing tenure and region. Job controls include dummies for occupation (1 digit), industry (1 digit), second job holding, alongside continuous variables for total hours worked and job tenure. ** indicates statistical significance at 5% level. Columns 4-6 pool observations for all years after 1999. Pooled sample size 446,647.

Table 2. Difference Estimates of 2015 Legislation on Accident Rates of Own Account Self-Employed v. High Risk Self-Employed

	(1)	(2)	(3)	(4)	(5)	(6)
Low Risk*2012	0.0073 (0.0084)	0.0068 (0.0084)	0.0076 (0.0084)			
Low Risk*2013	0.0090 (0.0086)	0.0087 (0.0086)	0.0095 (0.0086)			
Low Risk*2014	0.0076 (0.0083)	0.0073 (0.0083)	0.0077 (0.0083)			
Low Risk*2016	0.0076 (0.0086)	0.0069 (0.0086)	0.0068 (0.0086)			
Low Risk*2017	0.0166 (0.0085)	0.0168** (0.0085)	0.0169** (0.0085)			
Low Risk*2018	0.0155 (0.0083)	0.0153 (0.0083)	0.0155 (0.0083)			
Low Risk*2019	0.0185** (0.0083)	0.0184** (0.0083)	0.0185** (0.0083)			
Low Risk* After 2015				0.0084** (0.0041)	0.0084** (0.0041)	0.0081** (0.0041)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes

Source: UK LFS. **indicates significance at the 5% level. Robust standard errors in brackets. Personal controls include dummy variables for age, gender, qualifications, marital status, ethnicity, religion, presence and age of children, housing tenure and region. Job controls include dummies for occupation (1 digit), second job holding and overtime working, alongside continuous variables for total hours worked and job tenure. Pooled sample size 28,302.

Table 3. Difference Estimates of Low Risk Self Employed on Accident Rate v. Low Risk Employees

	(1) accident	(2) accident	(3) accident	(4) accident	(5) accident	(6) accident
Self Employed*2012	-0.0007 (0.0036)	-0.0009 (0.0036)	-0.0012 (0.0036)			
Self Employed*2013	-0.0020 (0.0037)	-0.0021 (0.0037)	-0.0024 (0.0037)			
Self Employed*2014	-0.0033 (0.0034)	-0.0036 (0.0034)	-0.0036 (0.0034)			
Self Employed*2016	-0.0010 (0.0037)	-0.0014 (0.0037)	-0.0014 (0.0037)			
Self Employed*2017	0.0038 (0.0039)	0.0038 (0.0039)	0.0040 (0.0039)			
Self Employed*2018	0.0009 (0.0036)	0.0008 (0.0036)	0.0012 (0.0036)			
Self Employed*2019	-0.0017 (0.0036)	-0.0019 (0.0036)	-0.0015 (0.0036)			
Self Employed*After 2015				0.0021 (0.0018)	0.0021 (0.0018)	0.0024 (0.0018)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes

Notes: See Table 2. Pooled sample size 183,999

Table 4. Difference Estimates of Placebo 2012 Legislation on Accident Rates of Own Account Low Risk Self-Employed v. High Risk Self-Employed

	(1)	(2)	(3)	(4)	(5)	(6)
Low Risk*2009	0.0050 (0.0083)		0.0046 (0.0083)		0.0003 (0.0084)	
Low Risk*2010	-0.0011 (0.0087)		-0.0015 (0.0087)		-0.0051 (0.0087)	
Low Risk*2011	0.0114 (0.0081)		0.0118 (0.0081)		0.0107 (0.0082)	
Low Risk*2013	0.0032 (0.0084)		0.0034 (0.0084)		0.0035 (0.0084)	
Low Risk*2014	0.0009 (0.0081)		0.0013 (0.0081)		0.0005 (0.0081)	
Low Risk*2015	-0.0072 (0.0087)		-0.0067 (0.0087)		-0.0078 (0.0087)	
Low Risk*After 2012		-0.0062 (0.0045)		-0.0057 (0.0045)		-0.0029 (0.0046)
Demographic	No	No	Yes	No	Yes	Yes
Work	No	No	Yes	No	Yes	Yes

Notes. See Table 2. Pooled sample size 26,274.

Table 5. Difference Estimates of 2015 Legislation Effects: Robustness Checks

	Men		Women		Manual Occupations		Non-Manual Occupations	
Low Risk*2012	0.0184 (0.0098)		-0.0312 (0.0189)		0.0100 (0.0126)		-0.0104 (0.0129)	
Low Risk*2013	0.0183 (0.0099)		-0.0244 (0.0192)		0.0130 (0.0126)		-0.0145 (0.0139)	
Low Risk*2014	0.0096 (0.0094)		-0.0014 (0.0141)		0.0229 (0.0141)		-0.0074 (0.0112)	
Low Risk*2016	0.0159 (0.0099)		-0.0316 (0.0192)		0.0198 (0.0138)		-0.0196 (0.0131)	
Low Risk*2017	0.0213** (0.0099)		-0.0044 (0.0156)		0.0313** (0.0154)		0.0070 (0.0100)	
Low Risk*2018	0.0200** (0.0097)		0.0019 (0.0128)		0.0198 (0.0132)		0.0054 (0.0096)	
Low Risk*2019	0.0252*** (0.0096)		-0.0094 (0.0159)		0.0352** (0.0140)		-0.0121 (0.0126)	
Low Risk* After 2015		0.0088 (0.0048)		0.0026 (0.0090)		0.0146** (0.0071)		0.0030 (0.0064)
Observations	19001	19001	9301	9301	12321	12321	15981	15981

Notes: See Table 2.

Appendix:

Table A1. Sample Means of Control Variables by Risky Sector Before & After 2016

	Before 2016			After 2016		
	Low Risk	High Risk	Difference	Low Risk	High Risk	Difference
Accident Rate	1.23 (0.013)	4.51 (0.023)	-3.3**	1.27 (0.013)	4.00 (0.039)	-2.7**
Days off Work	16.9 (20.4)	20.3 (34.2)	-3.4	21.2 (40.8)	13.3 (30.6)	8.9
% < 1 Week	18.3	28.5		34.5	34.2	
% > 1 Month	11.2	11.6		9.9	4.6	
% > 6 Months	0.01	0.3		1.7	0.8	
<i>Controls</i>						
Female	0.492 (0.005)	0.087 (0.003)	0.405**	0.530 (0.006)	0.099 (0.004)	0.430**
Age	45.8 (11.29)	44.9 (11.53)	0.91**	46.2 (11.34)	45.5 (11.33)	0.62**
<i>Qualifications</i>						
Higher Level 4	0.122 (0.003)	0.076 (0.004)	0.046**	0.107	0.089	0.018**
Level3:Vocational	0.210 (0.004)	0.357 (0.006)	-0.148**	0.194	0.304	-0.109**
Level3:Other	0.165 (0.004)	0.211 (0.005)	-0.046**	0.151	0.216	-0.065**
Level2	0.065 (0.003)	0.142 (0.004)	-0.077**	0.065	0.136	-0.072**
Other	0.044 (0.002)	0.099 (0.004)	-0.055**	0.038	0.101	-0.063**
Missing Quals.	0.008 (0.001)	0.014 (0.001)	-0.005**	0.015	0.024	-0.012**
Student	0.008 (0.001)	0.001 (0.001)	0.007**	0.007	0.002	0.005**
Immigrant	0.165 (0.004)	0.163 (0.005)	0.002	0.181	0.193	-0.012
Non-white	0.096 (0.003)	0.091 (0.004)	0.005	0.101	0.104	0.003
<i>Marital Status</i>						
Single	0.241 (0.005)	0.291 (0.006)	-0.049**	0.268	0.292	-0.023**
Divorced	0.100 (0.003)	0.094 (0.004)	0.006	0.099	0.094	0.005
Widowed	0.013 (0.001)	0.009 (0.001)	0.004	0.013	0.010	0.003
Civil partnership	0.005 (0.001)	0.001 (0.001)	0.004**	0.004	0.001	0.003**

No Children	0.556 (0.005)	0.574 (0.006)	-0.018	0.560	0.556	0.003
Social Tenancy	0.061 (0.002)	0.100 (0.004)	-0.039**	0.064	0.110	-0.045**
Private Rental	0.174 (0.379)	0.195 (0.396)	-0.021**	0.187	0.215	-0.028**
Works in London	0.148 (0.004)	0.128 (0.004)	0.019**	0.151	0.128	0.024**
Works in Wales	0.041 (0.002)	0.054 (0.003)	-0.013**	0.039	0.057	-0.018**
Works in Scotland	0.068 (0.003)	0.071 (0.003)	-0.003	0.064	0.067	-0.003
<i>Occupation</i>						
Professional/Technical	0.223 (0.002)	0.040 (0.005)	0.183**	0.226	0.051	0.175**
Associate Prof.	0.252 (0.003)	0.016 (0.005)	0.236**	0.258	0.023	0.234**
Administrative	0.045 (0.002)	0.0161 (0.002)	0.029**	0.043	0.017	0.026**
Skilled Manual	0.075 (0.002)	0.620 (0.006)	0.273	0.075	0.591	-0.515**
Caring/Leisure	0.121 (0.002)	0.007 (0.001)	-0.545**	0.118	0.010	0.108**
Sales	0.035 (0.002)	0.005 (0.001)	0.114**	0.027	0.004	0.023**
Plant & Processing	0.039 (0.001)	0.171 (0.005)	0.031**	0.039	0.176	-0.137**
Other Manual	0.073 (0.003)	0.063 (0.003)	0.010**	0.072	0.061	0.011**

Table A2. Injuries Arising From Accidents: Low v High Risk (Own Account) Self-Employed

	Before 2016		After 2016	
	Low Risk	High Risk	Low Risk	High Risk
Amputation	0.9	0.7	1.3	0.7
Fractures	11.2	12.8	12.3	14.1
Dislocation	0.01	3.7	4.6	3.8
Sprain	38.2	27.8	30.1	25.9
Bruising/Scratches	16.2	18.5	16.1	13.0
Lacerations	14.3	18.8	10.2	17.1
Loss of sight	0.00	1.3	1.1	0.00
Burns	2.1	1.4	0.01	0.8
Lack of oxygen	0.01	0.4	0.8	0.9
Other	15.7	11.3	18.0	22.8
Multiple injuries	1.4	3.2	5.5	1.0

Notes. Table shows % share of all accidents attributable to each outcome

Table A3. Difference Estimates of Low Risk Self Employed: Control Variables

	Demographic Only	Demographic+Job
Female	-0.0082*** (0.0017)	-0.0071*** (0.0020)
Age 25-34	-0.0036 (0.0057)	-0.0045 (0.0057)
Age 35-44	0.0006 (0.0058)	-0.0007 (0.0058)
Age 45+	-0.0016 (0.0058)	-0.0031 (0.0059)
<i>Qualifications</i>		
Higher Level 4	0.0038 (0.0030)	0.0013 (0.0030)
Level 3: Vocational	0.0103*** (0.0027)	0.0058** (0.0028)
Level 3: Non-Vocational	0.0068** (0.0028)	0.0023 (0.0030)
Level 2	0.0096** (0.0040)	0.0040 (0.0043)
Other	-0.0030 (0.0040)	-0.0090** (0.0044)
Missing Quals	-0.0017 (0.0088)	-0.0055 (0.0091)
Student	-0.0225*** (0.0046)	-0.0207*** (0.0049)
Works in London	-0.0037 (0.0027)	-0.0043 (0.0027)
Works in Wales	0.0077 (0.0053)	0.0069 (0.0053)
Works in Scotland	-0.0050 (0.0035)	-0.0055 (0.0035)
Non-white	0.0007 (0.0036)	0.0016 (0.0036)
Social Tenancy	-0.0031 (0.0028)	-0.0027 (0.0028)
Private Rental	0.0029 (0.0047)	0.0024 (0.0047)
EU-born	-0.0049 (0.0039)	-0.0050 (0.0039)
Non-EU born	0.0015 (0.0036)	0.0018 (0.0036)
Number of dependent children in household aged under 19	0.0016 (0.0018)	0.0018 (0.0018)
Age Youngest Child	0.0001 (0.0003)	0.0001 (0.0003)

<i>Marital Status</i>		
Single, never married	0.0010 (0.0027)	0.0002 (0.0027)
Divorced	0.0105*** (0.0038)	0.0098*** (0.0038)
Widowed	-0.0080 (0.0060)	-0.0083 (0.0060)
Civil partnership	-0.0137*** (0.0021)	-0.0142*** (0.0023)
<i>Religion</i>		
No Religion	0.0012 (0.0020)	0.0012 (0.0020)
Budhist	0.0225 (0.0169)	0.0210 (0.0169)
Jewish	-0.0123*** (0.0018)	-0.0108*** (0.0019)
Muslim	0.0042 (0.0060)	0.0023 (0.0060)
Any Other Religion	0.0144** (0.0070)	0.0140** (0.0070)
<i>Job Characteristics</i>		
Job Tenure		0.0001 (0.0001)
Works in House		-0.0001 (0.0027)
Works in Garden		-0.0015 (0.0059)
Uses Home as a Base		0.0071** (0.0029)
Total hours worked		0.0001 (0.0001)
Two Jobs		-0.0002 (0.0040)
Live and work in same LAD		0.0033 (0.0034)
Works Mondays		-0.0080*** (0.0031)
Works Saturdays		0.0061 (0.0034)
Works Sundays		0.0045 (0.0041)
Works Odd days		-0.0057 (0.0034)
<i>Occupation</i>		
Professional/Technical		-0.0047

		(0.0026)
Associate Professional		0.0036
		(0.0028)
Administrative		-0.0064**
		(0.0029)
Skilled Manual		0.0138***
		(0.0037)
Caring/Leisure		0.0087
		(0.0048)
Sales		0.0019
		(0.0051)
Plant & Processing		0.0131**
		(0.0056)
Other Manual		0.0114**
		(0.0045)
<hr/>		
Observations	28302	28302
<hr/>		

Standard errors in parentheses

** $p < 0.05$, *** $p < 0.01$

Table A4. Difference Estimates of Low Risk Self Employed: Number of Days Off Work

	Total		Men		Manual	
Low Risk*2012	0.0761 (0.1880)		0.1572 (0.2278)		0.2160 (0.2667)	
Low Risk*2013	-0.2391 (0.3247)		-0.1516 (0.3833)		-0.2077 (0.3725)	
Low Risk*2014	0.1308 (0.1609)		0.1612 (0.1813)		0.2837 (0.1881)	
Low Risk*2016	0.2897 (0.2308)		0.2464 (0.2349)		0.3168 (0.2482)	
Low Risk*2017	0.4353** (0.2018)		0.5442* (0.2865)		0.3751* (0.2110)	
Low Risk*2018	0.4380*** (0.1367)		0.5108** (0.1557)		0.6064** (0.1571)	
Low Risk*2019	0.1417 (0.2364)		0.2059 (0.2681)		0.4408 (0.3207)	
Low Risk* After 2015		0.3332*** (0.1151)		0.3323** (0.1401)		0.3573** (0.1394)
Demographic	No	No	Yes	Yes	Yes	Yes
Work	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28112	28112	18834	18834	12190	12190

Standard errors in parentheses

** $p < 0.05$, *** $p < 0.01$

Table A5. Difference in Difference Estimates of Low Risk Self Employed on Accident Rate v. Low Risk Employees

	(1)	(2)	(3)	(4)	(5)	(6)
Self Employed*2012	-0.0007 (0.0036)	-0.0009 (0.0036)	-0.0012 (0.0036)			
Self Employed*2013	-0.0020 (0.0037)	-0.0021 (0.0037)	-0.0024 (0.0037)			
Self Employed*2014	-0.0033 (0.0034)	-0.0036 (0.0034)	-0.0036 (0.0034)			
Self Employed*2016	-0.0010 (0.0037)	-0.0014 (0.0037)	-0.0014 (0.0037)			
Self Employed*2017	0.0038 (0.0039)	0.0038 (0.0039)	0.0040 (0.0039)			
Self Employed*2018	0.0009 (0.0036)	0.0008 (0.0036)	0.0012 (0.0036)			
Self Employed*2019	-0.0017 (0.0036)	-0.0019 (0.0036)	-0.0015 (0.0036)			
Self Employed*After 2015				0.0021 (0.0018)	0.0021 (0.0018)	0.0024 (0.0018)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes

Notes see Table 2. Sample size 183999

Table A6. Difference Estimates of Low Risk Self Employed v. Broader High Risk Self-Employed

	(1)	(2)	(3)	(4)	(5)	(6)
Low Risk*2012	0.0088 (0.0086)	0.0082 (0.0086)	0.0088 (0.0086)			
Low Risk*2013	0.0114 (0.0087)	0.0112 (0.0087)	0.0122 (0.0087)			
Low Risk*2014	0.0088 (0.0084)	0.0083 (0.0084)	0.0086 (0.0083)			
Low Risk*2016	0.0101 (0.0087)	0.0094 (0.0087)	0.0091 (0.0087)			
Low Risk*2017	0.0174** (0.0086)	0.0175** (0.0086)	0.0175** (0.0086)			
Low Risk*2018	0.0180** (0.0084)	0.0177** (0.0084)	0.0177** (0.0084)			
Low Risk*2019	0.0226*** (0.0083)	0.0226*** (0.0083)	0.0228*** (0.0083)			
Low Risk* After 2015				0.0095** (0.0041)	0.0096** (0.0041)	0.0091** (0.0041)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes

Notes see Table 2. Sample size 27823

Table A7. Triple Difference Estimates of Low Risk Self Employed on Accident Rate v. Low Risk Employees and High Risk Self-Employed

	(1)	(2)	(3)	(4)	(5)	(6)
Low Risk*Self Employed*2012	0.0062 (0.0096)	0.0057 (0.0096)	0.0059 (0.0096)			
Low Risk*Self Employed*2013	0.0034 (0.0097)	0.0032 (0.0097)	0.0037 (0.0097)			
Low Risk*Self Employed*2014	0.0055 (0.0095)	0.0050 (0.0095)	0.0050 (0.0094)			
Low Risk*Self Employed*2016	-0.0031 (0.0097)	-0.0039 (0.0097)	-0.0044 (0.0096)			
Low Risk*Self Employed*2017	0.0103 (0.0096)	0.0103 (0.0096)	0.0103 (0.0096)			
Low Risk*Self Employed*2018	0.0083 (0.0094)	0.0082 (0.0093)	0.0081 (0.0093)			
Low Risk*Self Employed*2019	0.0101 (0.0094)	0.0098 (0.0094)	0.0103 (0.0094)			
Low Risk Self Employed*After 2015				0.0024 (0.0046)	0.0024 (0.0046)	0.0021 (0.0046)
Demographic	No	Yes	Yes	No	Yes	Yes
Work	No	No	Yes	No	No	Yes
Observations	223001	223001	223001	223001	223001	223001

Notes: See Table 2.

Table A8. Difference Estimates of No Treatment Groups on Accident Rate

	High risk Self-Employed v. High risk Employees		High risk Employees v. Low risk Employees	
	(1)	(2)	(3)	(4)
2012	0.0007 (0.0043)		2012	0.0003 (0.0043)
2013	-0.0030 (0.0042)		2013	-0.0034 (0.0042)
2014	-0.0007 (0.0042)		2014	-0.0013 (0.0042)
2016	-0.0094** (0.0040)		2016	-0.0100** (0.0040)
2017	-0.0042 (0.0043)		2017	-0.0047 (0.0043)
2018	-0.0098** (0.0041)		2018	-0.0103** (0.0040)
2019	-0.0076* (0.0042)		2019	-0.0086** (0.0042)
High Risk SE*2012	-0.0064 (0.0070)		Low Risk*2012	0.0012 (0.0044)
High Risk SE*2013	-0.0043 (0.0070)		Low Risk*2013	0.0064 (0.0044)
High Risk SE*2014	-0.0068 (0.0068)		Low Risk*2014	0.0025 (0.0043)
High Risk SE*2016	0.0054 (0.0070)		Low Risk*2016	0.0116*** (0.0042)
High Risk SE*2017	-0.0052 (0.0070)		Low Risk*2017	0.0051 (0.0044)
High Risk SE*2018	-0.0019 (0.0068)		Low Risk*2018	0.0086** (0.0042)
High Risk SE*2019	-0.0078 (0.0069)		Low Risk*2019	0.0081* (0.0044)
After 2015		-0.0070*** (0.0021)	After 2015	-0.0073*** (0.0020)
High Risk SE*After 2015		0.0023 (0.0034)	Low Risk*After 2015	0.0059*** (0.0021)
Demographic	Yes	Yes	Yes	Yes
Work Observations	Yes 44255	Yes 44255	Yes	Yes 185655

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