The economic consequences of accidents at work

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Abstract

This paper investigates the economic consequences of workplace accidents in the British labour market. For the empirical analysis, I use data on employment and earnings from the British Household Panel Survey and exploit fixed effects estimators to control for time-invariant unobserved workers' characteristics. I provide evidence that accidents at work negatively affect both job opportunities and workers' earnings. First, employment probabilities following a state of injury are significantly lower. This effect persists over time and is stronger in those regions where the macroeconomic conditions are worse. Second, a serious workplace accident also results in significant delayed wage penalties, which increase with the accident's seriousness. The effect is lower in the public sector and unionized firms, where job and earnings protection is higher and physically demanding working conditions are not widespread, or if the worker moves to a new job which suits his/her post-injury abilities better.

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1. Introduction

Accidents at work are critical events that negatively affect the health status of workers, who may experience illnesses, disabilities and, in the most serious cases, death. Although the majority of workplace accidents result in minor injuries with only limited health consequences,[1] in a number of cases injured workers suffer from long-term health problems or permanent disabilities. The costs associated with accidents at work are both direct and indirect. Direct costs are related to medical and rehabilitation care and to income losses, namely the loss of gross earnings due to absence from work net of replacement income.[2] Indirect costs, which are more difficult to measure, include a higher probability of unemployment due to the inability to work in heavy-duty jobs or for long hours. Moreover, accidents can also have effects later in the worker's life cycle. This can result in lower chances of returning to the labour market, slower career advancement, and reduced wage-earning capacity.

This paper focuses on the labour market in Great Britain and estimates the economic costs of accidents at work on labour-market outcomes. This analysis is motivated by a general lack of evidence with respect to this issue. With the exception of a number of analyses focusing on the US, this issue has been largely ignored by the empirical literature on risk at work and occupational accidents. The aim of the paper is to fill this gap. It shows that the presence of labour-market failures results in inadequate compensation for injured workers. This may justify the intervention of policy-makers with the twofold aim of increasing safety-at-work standards and avoiding the occurrence of indirect costs for injured workers in the case of accident. The focus of policy-making intervention should then be to support the return to work of injured workers and an appropriate post-injury match between worker and job.

In the years 2009-2010, the total costs associated with workplace injuries in Great Britain were estimated at £5.4 billion (Health and Safety Executive 2012). More than half of these costs were borne by the victims, but the employer and society at large also shared the burden.[3] The costs associated with serious accidents were particularly high. Minor occupational injuries represented the majority of accidents, but they accounted for only 2.12 per cent of the total economic costs (Fig.1). Conversely, more serious accidents were less frequent, but they accounted for 93.25 per cent of the estimated economic cost.[4] This highlights the importance of

[1] Statistics provided by Health and Safety Executive, referring to 2009/2010, report the occurrence of around 700,000 occupational accidents, 400,000 of which caused a minor injury, that is, an injury resulting in less than 4 days absence from work. Moreover, Eurostat (2004) indicates that prolonged sick leave (one month or more) was reported by 22 percent of workers who had suffered an accident at work. In addition, only 1.8 percent of injuries entailed disabilities for more than one year following the accident (Eurostat, 2004).

[2] Net replacement of income consists of sick pay and state benefits. Statistics provided by the Health and Safety Executive estimate health and rehabilitation care at £124 million and losses in income at £803 million in 2009/2010.

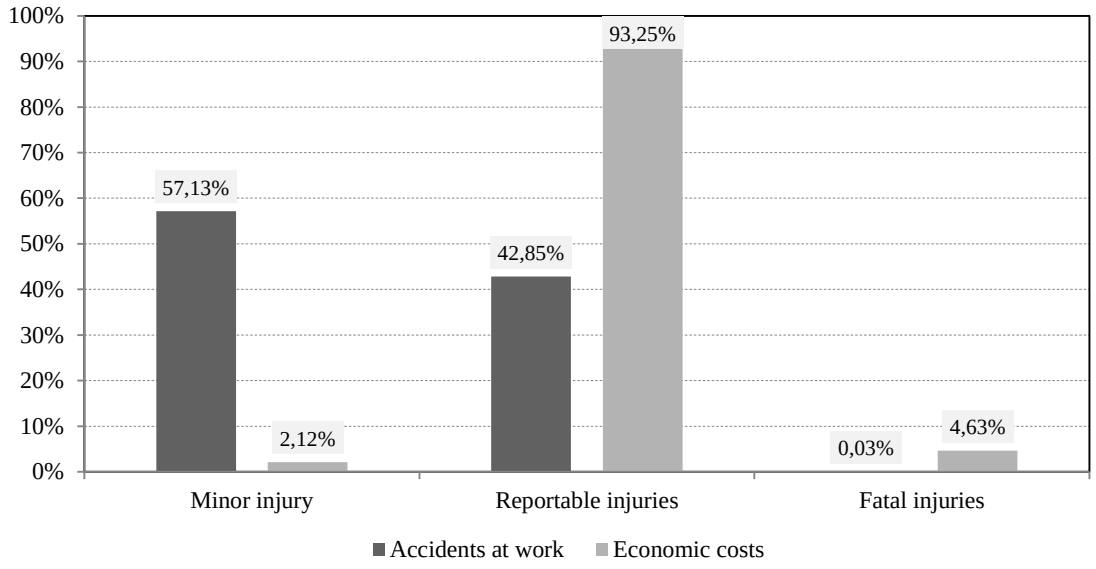
[3] For the employer, an accident entails sick pay payments, insurance premiums, production disturbance costs, administrative and legal costs, and loss of resources that may be difficult to monetize. For the society, an accident entails costs arising from loss of earnings to the individual (benefits payments, reduction in tax and national insurance receipts), medical treatment and rehabilitation costs, and administration and legal costs.

[4] Serious accidents were relatively rare events: 1.6 per cent of total accidents entailed a 15 per cent disability level, 0.2 per cent resulted in 100 per cent disability, and 0.1 per cent in a fatal injury. Nevertheless, they accounted for the largest part of the total labour costs: injuries causing 15 per cent disability accounted for 32.7 per cent of the total labour costs, 100 per cent disability for 27 per cent, and fatal accidents for 8 per cent. These statistics highlight the importance, in terms of labour costs, of accidents causing long-lasting or permanent injuries or with fatal consequences (Eurostat, 2004).

further investigating the economic consequences of accidents giving rise to long-lasting or permanent injuries.

Despite the considerable economic consequences associated with serious accidents at work, only few studies have dealt with this topic. Focusing on the US labour market, Boden and Galizzi (1998, 1999, 2003a), Reville (1999), Reville and Schoeni (2001) and Reville et al. (2002), Biddle (1998) and Woock (2009a, 2009b) identified substantial earnings losses in the short term but indicated a partial recovery in the long term, generally due to stable post-injury employment. Similar findings have been reported by Butler et al. (2006) and Crichton et al. (2011), who investigated the consequences of an occupational accident in Canada and New Zealand, respectively. No study is available for any European country. By focusing on the labour market in Great Britain, this paper is thus the first contribution to filling an important gap in the literature.

Fig.1: Distribution of accidents at work and the incidence of each kind of accident on the total costs in 2009/2010



Source: Health and Safety Executive (2012)

Several examples of the negative relationship between occupational injuries and labour-market outcomes can be found in the theoretical literature. During the recovery period after a severe injury, workers may experience a reduction in job-specific human capital which may result in earnings penalties (Reville and Schoeni, 2001). This is particularly the case if the employer and the local labour market cannot offer alternative jobs suited to the worker's reduced abilities. Workers may also experience a decrease in their labour productivity due to their ability to perform fewer tasks, to imprecise and unsatisfactorily outcomes, or to a lower probability of fulfilling specific targets defined by pay-for-performance mechanisms. Moreover, in the presence of compensating wage differentials assigned to workers in riskier occupations, moving from particularly risky jobs to safer ones as a consequence of workplace accidents may entail significant earnings losses. Finally, employment probabilities may be lower as a result of employers' discrimination against injured workers, such as refusal to offer the same employment opportunities to victims of accidents.

This paper offers three main contributions to the literature on risk at work and occupational accidents. First, I conduct an empirical analysis of the economic consequences of serious occupational accidents on labour-market outcomes in Great Britain using the 1991-2008 waves of the British Household Panel Surveys. In particular, I exploit information on whether a worker receives the *Industrial Injuries Disablement Benefit (IIDB)*, a state allowance for workers injured in a workplace accident. The main advantage of using the *IIDB*, rather than workers' self-reported assessments, is a significant reduction in the measurement error associated with identifying the nature and seriousness of an accident at work.

Second, I use fixed effects estimators to measure the effects of a work-related accident and the extent to which the seriousness of an injury affects labour-market outcomes. The aim of the analysis is to highlight what economic indirect costs are borne by the worker as a consequence of an occupational accident. To this end, I focus on employment probabilities and earnings losses for those injured workers who remain in employment after an occupational accident.

Finally, I speculate on the main explanations for my findings, testing whether the negative effects of an occupational accident on labour-market outcomes may be mitigated in the presence of specific economic conditions and higher job and earnings protection. This issue is particularly important for policy-makers intending to design effective policy interventions to reduce the costs borne by the victims of occupational accidents.

The paper is organized as follows. Section 2 reviews the relevant literature on risk at work and workplace accidents, paying particular attention to studies that investigate the economic consequences of an accident at work. Section 3 describes the institutional background to occupational health and safety regulations in Great Britain. It focuses specifically on provisions enacted in order to ensure adequate compensation for injured workers. Section 4 presents the dataset description and descriptive statistics. Section 5 introduces the empirical issues linked with estimating the effects of injury on labour-market outcomes. Section 6 sets out the results and the sensitivity analysis; concluding remarks follow.

2. Literature review

Notwithstanding the great efforts made in recent years to estimate the value of statistical life – see Viscusi and Aldy (2003) for a survey – and to identify the main determinants of accidents at work,[5] one of the major shortcomings of the literature is the absence of studies on how occupational injuries affect labour-market outcomes in the EU. All studies investigating the

[5] Two main questions are investigated. First, a number of studies have examined how workers' socio-demographic characteristics affect job sorting according to risk at work (DeLeire and Levy, 2004; Grazier and Sloane, 2008; Schaffner and Kluve, 2007) and the rates of workplace accidents (Berger and Gabriel, 1991; Hamermesh, 1998; Hersch, 1998; Bauer et al., 1998; Leeth and Ruser, 2006; Leombruni et al., 2009). Second, an extensive literature shows how firm and job characteristics impact on the probability of accident. It investigates the role of unionization (Litwin, 2000; Baugher and Roberts, 1999; Fenn and Ashby, 2004); the existence of a pure "contractual effect" against workers employed with fixed-term contracts (Guadalupe, 2003; Amuedo and Dorantes, 2002; Hernanz and Toharia, 2004; Garcia-Serrano et al., 2010; Williamson et al., 2009); the relationship between working time and occupational accidents (Wilkins, 2004); how innovative work organization practices affect the occurrence of an accident at work (Fairris and Brenner, 2001; Brenner et al., 2004; Askenazy, 2001; Askenazy and Caroli, 2010); the relationship between macroeconomic conditions and cyclical fluctuations of the rate of occupational injuries (Ruhm, 2000; and Boone and van Ours, 2006; Boone et al., 2011) and the return to work after a workplace accident (Boden and Galizzi, 2003b).

economic consequences of occupational injuries are focused on the US labour market – with the exception of Butler et al. (2006) and Crichton et al. (2011), who studied the effect, respectively, in Canada and in New Zealand. The majority of these studies use information provided by WC claims data and find a similar pattern on estimating the earnings losses consequent on a workplace injury. After an occupational injury, earnings losses are immediately substantial, and only after several years is there a partial recovery, generally due to stable post-injury employment.

Using WC claims data with unemployment records from Wisconsin, Boden and Galizzi (1998, 1999, 2003a) reported that earnings losses were concentrated in the first two quarters following injury (on average, $4,200 for injured men) and then decreased up to the fourth year (about $12,700). The authors also found significant differences in earnings losses by gender: in the three and a half years after the post-injury quarter, women lost on average 9.2 per cent of earnings, while men lost only 6.5 per cent. Using Blinder-Oaxaca Neumark decomposition, the authors argued that only half of this gender gap was explained by higher probabilities of job loss for working women. By contrast, the contribution of employment and injury characteristics was not statistically significant in explaining gender differences in earnings losses.

Reville (1999), Reville and Schoeni (2001) and Reville et al. (2002), on using a unique California administrative dataset,[6] found that the negative impact of injury in terms of earnings losses was largely explained by a decrease in the employment rate. In particular, Reville and Schoeni (2001) studied the economic consequences of the *Permanent Partial Disabilities (PPD)* scheme, finding significant earnings losses for injured workers (around 25 percent of earnings) up to four/five years after a serious occupational accident. On analysing the determinants of earnings losses, the authors found a positive correlation with the severity of a workplace accident. Similar findings are also highlighted in Biddle (1998), who used WC claims data from the state of Washington.

Crichton et al. (2011) used data on the New Zealand labour market[7] to show that injury duration and earnings losses are strongly correlated. The effects of longer-duration injuries did not decline over the first 18 months after leaving the insurance system. Their results indicated that the employment rate and total income of injured workers are, respectively, 20 and 25 per cent lower than those of non-injured workers.

Most recently, Butler et al. (2006) have analysed data from the *Survey of Ontario Workers with Permanent Impairments* and showed significant productivity losses related to the spells of work absence in the first year after injury. In the following years, only workers in unstable employment patterns continued to incur large earnings losses determined by the repeated spells of injury-related work absence. By contrast, workers in stable employment were only affected by limited losses in the second and third year. This might have been due to periods of work at reduced wages or reduced hours.

[6] The authors used a unique dataset obtained by matching the *1989 - 1995 Uniform Statistical Reporting Plan (USR)* database from the *Workers' Compensation Insurance Ratings Bureau (WCIRB)* with the *Base Wage* file from the *State of California Employment Development Department (EDD)*

[7] The authors used *1999 – 2004 New Zealand accident insurance system (ACC)*, together with data on earnings compensation provided by *Statistics New Zealand's (SNZ) Linked Employer-Employee Database.*

Woock (2009a) estimated earnings losses by including in the analysis also injured workers who did not receive WC benefits and using uninjured workers as a comparison group. The author found that omitting workers with a minor injury led to estimates of annual earnings losses 1.6 to 2.7 times larger than those obtained by comparing all injured workers to a comparison group of uninjured workers. Moreover, Woock reported that annual earnings losses varied according to the severity of the workplace accident: from $ 600 to $ 2,900, considering injured men who did not receive WC; from $4,200 to $5,800, for WC recipients; and from $ 5,000 and $ 14,000 for those reporting a work-limiting disability after the injury. In a further contribution, Woock (2009b) has underlined that earnings losses due to work-related injuries are mitigated by the presence of trade unions in bargaining on workers' wages. The author argues that differences in earnings between injured and non-injured workers are statistically significant only among non-unionized injured workers.

3. Occupational Health and Safety Regulation in Great Britain

Government interventions to regulate occupational health and safety are necessary to guarantee that the most risk-averse party, namely the victim, does not bear the entire economic cost of a workplace injury (see Shavell, 2007, for a survey). The economic consequences of an accident at work in the British labour market can be appropriately analysed only in light of the institutional framework currently regulating that market. Variations in insurance systems and in work injury programmes may significantly alter the effects of a workplace accident on labour-market outcomes. According to Boden and Galizzi (2003b), for example, significant state aid could result in workers deciding to remain outside the job market whenever the accident has been particularly serious and led to a significant reduction of the injured worker's earnings. Not taking appropriate account of the existence of state aid for injured workers in an empirical analysis will lead to an overestimation of the negative effects of accidents on employment probabilities if the policy provisions influence the choice returning to work. Conversely, the existence of benefits may lead to an underestimation of earnings losses whenever injured workers can accept lower wages as a result of additional state benefits.

Occupational health and safety legislation in Great Britain is defined by the *1974 Health and Safety at Work (HSW) Act* and its subsequent amendments. These amendments were inspired by the *European Framework Directive 89/391* and by the *Management of Health and Safety and Work Regulations*, implemented in 1999. The fundamental principle defined by the *HSW Act* establishes that the employer is legally responsible for health and safety at work, and is in charge of assessing workplace risks, adopting all measures and practices appropriate to avoiding them, and providing adequate occupational health services (OHS). When an occupational accident occurs, the employer is required to report injuries, diseases and dangerous occurrences in an *accident book* and to notify them to the *Health and Safety Executive* or to the local authorities. The *accident book* should contain detailed information on occupational accidents resulting in death or injuries that prevent workers from carrying out their normal work for more than three days.

When injured workers need time off to recover, they are entitled to receive sick pay from the employer. The employer can decide to arrange a discretional company sick pay scheme or to guarantee the *Statutory Sick Pay (SSP)*, which represents the legal minimum and is paid by the

employer on behalf of the government.[8] If workers suffer a physical injury and/or a mental disorder as a result of the employer's non-compliance with the duties stated in the *HSW Act*, they can claim for additional compensation on top of the sick pay mentioned above. Employers' liability insurance, which is compulsory according to the *Employers' Liability (Compulsory Insurance) Act* of 1969, covers all the costs of claims for compensation related to noteworthy accidents at work: the insurer will pay the full amount of any compensation agreed between employers and employees or awarded to employees by a court.

The occurrence of a particularly serious occupational injury also allows the worker to claim for the *Industrial Injuries Disablement Benefit (IIDB)*. The *IIDB* is provided by the state in order to cover any costs for injuries resulting from accidents at work. The amount of the allowance granted to the worker is strictly dependent on the health consequences of the workplace accident. The nature and the seriousness of an occupational injury are determined, respectively, by the *Department for Work and Pensions* (*DWP*) with the *accident declaration*, and by a qualified doctor through an assessment of disability.[9] The *accident declaration* certifies whether the injury can be considered by law as an industrial accident. A medical examination certifies the severity of the worker's disability and for how long s/he will be unable to work. The total revenue obtained from this claim by the worker is the product of the number of weeks needed to recover the pre-injury health status and the assessment of the disability, with a minimum qualifying disability of 14 per cent.[10] In the case of temporary injury, at the end of the period covered by the allowance, the worker can ask for a renewal if the injury is still not resolved.

Other benefits available to injured employees are the *Reduced Earnings Allowance (REA)*, assigned when the employee cannot do his/her usual job or other work with similar pay because of a disease or an injury caused by his/her job; the *Constant Attendance Allowance (CAA)* and the *Exceptionally Severe Disablement Allowance (ESDA)*, provided to employees who receive the *IIDB* at the 100 per cent rate and need daily care and attention; the *Analogous Industrial Injuries Scheme (AIIS)*, paid exclusively to trainees who have an accident during a work-based training programme and, consequently, are not entitled to receive *IIDB*.

Besides financial aid for injured workers, in 1995 the British government enacted the *Disability Discrimination Act* in order to prevent any form of discrimination against injured workers in the workplace.[11] The *Disability Discrimination Act* guarantees that the employers do not discriminate against injured individuals when offering employment through any arrangement, terms of contract, or deliberate refusal. It also ensures that injured workers are granted the same on-job opportunities in terms of promotions, transfers, training programmes and other benefits.

[8] Work injury programmes in Great Britain are described in detail on the *Directgov* website (http://www.direct.gov.uk).

[9] For the worker to receive the benefit, the *DWP* must rule that the accident can be considered an industrial accident. This is done by acquiring information from the *accident book* and, if necessary, requesting more details from the employer. When the *DWP* approves the *accident declaration*, thus confirming that the accident is due to work activities, the employee is entitled to receive, through *Job Centre Plus*, an allowance calculated according to the severity of the injury, which is assessed by a qualified doctor.

[10] Injured workers are entitled to the benefit after the first 15 weeks of disability following an accident, independently of the moment when the *IIDB* is certified. The amount of the allowance, according to the level of disability, is defined automatically using a fixed scale: in 2012, from £ 31.62 per week for 20 per cent disability to £ 158.10 per week for 100 per cent disability.

[11] The Act was repealed and replaced by the Equality Act 2010, which transposed the four major EU Equal Treatment Directives in order to consolidate and renew the complicated anti-discrimination law in Great Britain.

4. Data and descriptive statistics

The empirical analysis now presented was based on an unbalanced panel from the British Household Panel Survey (BHPS), which provides information on a sample of adult British individuals from 1991 to 2008. For the purpose of the analysis, the sample was restricted to individuals aged 16-65 and eligible for work.[12] The sample was thus composed of 22,510 individuals in 18 BHPS waves, for a total of 126,922 observations. Note that the BHPS is a large and lengthy longitudinal dataset with many observations for a long time span. Hence it is the ideal source of data with which to study the consequences of rare events, such as accidents at work.

The questionnaire provides information on labour market outcomes in terms of employment status and labour earnings. The dependent variable used to analyse employment probabilities was the dummy variable *E*, which was equal to 1 if the worker was employed at the time of the interview and to 0 otherwise. In my sample, the employment rate was almost constant over time and around 78 per cent.[13] Conversely, to estimate earnings losses caused by an occupational accident, I used the logarithm of hourly wage (*ln_yhrl*) as the dependent variable. This variable was constructed using information on annual labour income and hours normally worked per week.[14] When focusing on wage effects, I restricted the sample to individuals employed at time *t* and for whom the variable *ln_yhrl* was observed. This sub-sample was composed of 15,356 individuals, for a total of 89,845 observations.[15] Mean hourly wage ranged from £ 5.82 in the first wave (1991) to over £ 11.54 in the last wave (2008).[16]

To estimate correctly the effect of an occupational accident on labour market outcomes, I had to assess the nature and the severity of a workplace accident. In this regard, workers' self-reported data usually give rise to measurement problems. The problem is particularly significant for minor occupational accidents leading to small and unsubstantial economic consequences. To minimize the measurement error, I used information on whether a worker received the *Industrial Injury Disablement Benefit (IIDB)*[17] as a proxy for the occurrence of an accident at work. With respect to workers' self-reported assessments, the *IIDB* led to a significant reduction in the measurement error associated with identifying the nature and seriousness of an accident at work. In the *IIDB*, the seriousness of the injury is certified by the *accident declaration* and assessed by a qualified doctor. For the purpose of my empirical analysis, a dummy variable indicated whether the worker had been injured due to an occupational accident and, as a

[12] I excluded full-time students, individuals on maternity leave, involved in family care and in government training programmes. In order to compare the results to statistics on the total costs associated with workplace injuries in Great Britain, I eliminated from the sample individuals living in Northern Ireland.

[13] The employment rate was higher than aggregate statistics issued by the UK Office for National Statistics: 77.87 per cent in this dataset, 71.42 per cent according to data from Labour Market Statistics Dataset.

[14] I used the hourly wage to avoid spurious effects related to variations in working hours that might result if the accident led to a reduction in the workload. To check the robustness of these findings to the definition of the income variable, in the subsection devoted to the sensitivity analysis I perform various estimations using different definitions of earnings.

[15] I excluded non-employed individuals and workers without a labour contract.

[16] Mean hourly wages were in line with the aggregate statistics provided by *Annual Survey of Hours and Earnings (ASHE)* for the labour market in Great Britain.

[17] The question used to construct the dummy variable was formulated in the following way: *"Please tell me if, since September 1st of previous year, you have received the Industrial Injury Disablement Allowance".* Details on the *IIDB* are provided in Section 2.

consequence, received the *IIDB* in the previous 12 months.[18] I exploited the lagged value of the *IIDB* to account for the fact that there may be a time lag between the occurrence of a state of injury as a consequence of an accident at work and the labour-market effects. In line with the literature on effects of health on the labour market outcomes,[19] a one-year time lag was used to capture the delayed effect of an accident at work. In the subsection devoted to the sensitivity analysis, I also present results using longer lags to account for the time taken by a serious accident at work to deteriorate labour-market outcomes.[20]

Information on the occurrence of a state of injury was also used to identify the relationship between the seriousness of an accident at work and the effects on labour-market outcomes. The lack of any information on the *assessment of disability* required proxying the seriousness of an occupational accident with the duration of the disability at the time of the interview. A discrete variable measured the number of years in which the *IIDB* had been paid to the injured worker. The variable assumed value 0 until the worker received the *IIDB* as a consequence of a serious occupational accident. Upon occurrence of a work-related injury, the variable assumed value 1 and, if the injury persisted over time, it increased according to the number of years of injury suffered up to the time of the interview.[21]

The descriptive statistics presented in Fig.2 suggest that a state of injury following a serious occupational accident has an immediate negative impact on the probability of employment. Injured individuals seem to experience reduced job opportunities both in the short term (50.37 per cent and 79.61 per cent are respectively the employment rates of injured and non-injured individuals, when the state of injury is captured at time of the interview) and in the long term. Indeed, differences in employment rates between injured and non-injured individuals remain almost constant over time.

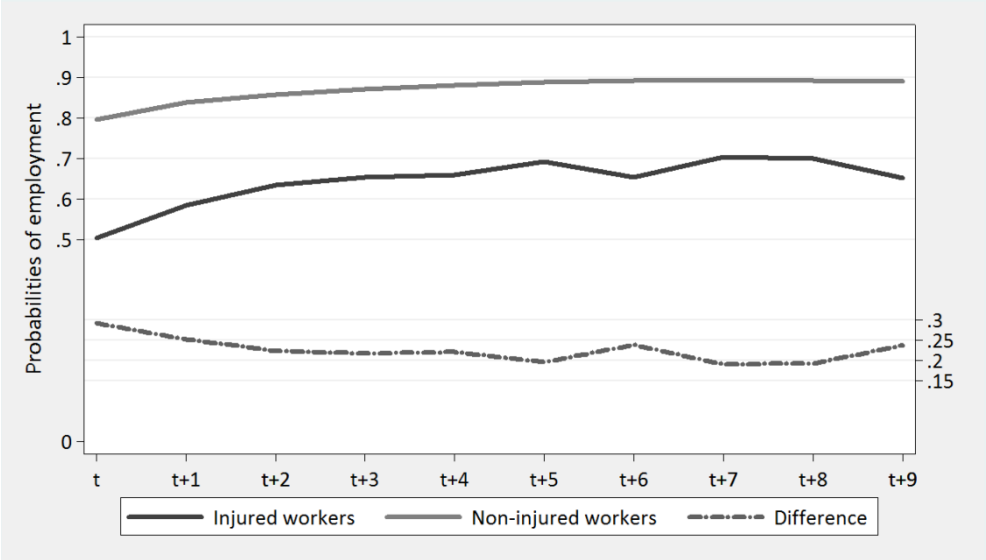
Focusing on effects of a workplace injury on the hourly wage, the stylized facts presented in Fig.3 show initially negligible differences between wages earned by injured workers and by non-injured workers (only 2.56 per cent lower among injured workers). Wage differences increase starting from the period following the injury and do not exhibit any evidence of reducing over time.

However, these differences may be due, not to the injury itself, but to the existence of differences in workers' demographic characteristics and job and firm attributes between injured and non-injured workers.[22] In order to control for this aspect, I added a set of control variables to the models. Time varying demographic characteristics of the respondents included age class and family composition. To proxy for job attributes, I used information on the respondent's working qualifications.[23] Firm characteristics included industry, number of employees at the

[18] The amount of the *IIDB* was not included in computation of the hourly wage.
[19] Bound et al. (1999) and García-Gómeza et al. (2010) use the lagged health to study delayed effects on labor-market transitions.
[20] For the robustness analysis, I used the lagged values of the variable, which captured whether the worker had experienced a state of injury following an occupational accident in the five years before the interview (up to time *t-4*).
[21] Since it is not possible perfectly to identify the occurrence of an occupational accident, I assumed that each injured worker received all the benefits as consequences of a single accident. This assumption is plausible if one considers the relatively slight probability of receiving the *IIDB* for two or more different workplace accidents.
[22] A complete list of the variables used in the analyses and descriptive statistics are available in the Appendix.
[23] Qualifications were defined according to the International Standard Classification of Occupations – ISCO. Industries were classified using the International Standard Industrial Classification of All Economic Activities – ISIC.

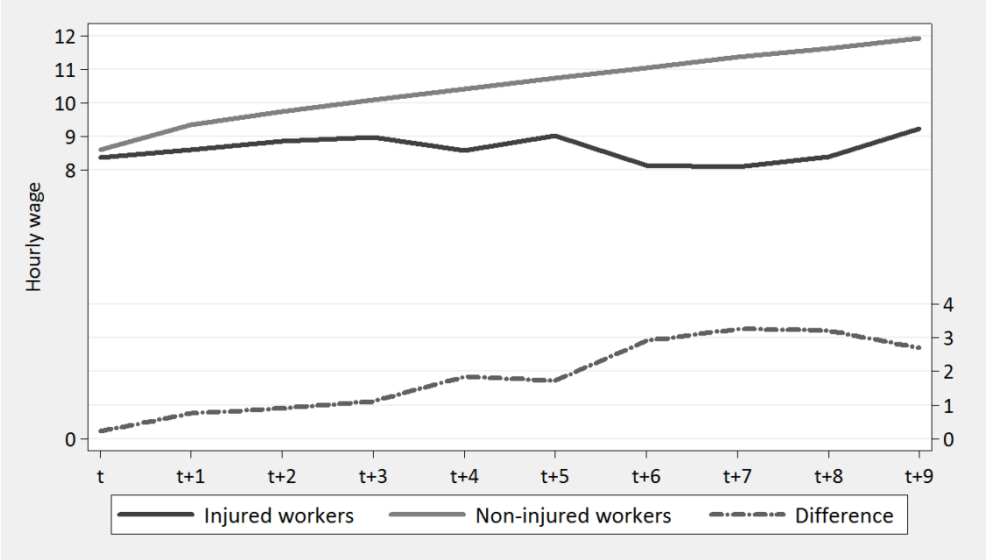
workplace, and presence of trade unions. I also added dummy variables which identified the duration and the type of employment contract. Moreover, to eliminate the heterogeneous effects due to unobserved differences in regions within Great Britain and to time effects from the empirical analysis, I included a set of regional dummy variables and a set of time dummy variables.

Fig.2: Differences in employment probabilities between injured and non-injured workers.



Source: British Household Panel Survey - Wave 1 - 18 (1991-2008)

Fig. 3: Differences in hourly wage between injured and non-injured workers.



Source: British Household Panel Survey - Wave 1 - 18 (1991-2008)

I also included in the analysis a variable indicating whether the worker had recently changed jobs. The BHPS does not include any firm identifier; thus I identified a job change by exploiting differences in stylized jobs over a certain time span. Stylized jobs in my sample were identified by combining information about occupation, industry and number of employees at the

workplace.[24] I thus constructed a dummy variable which assumed value 0 if the characteristics of the stylized job did not change from time *t-1* to time *t* and value 1 otherwise.

5. Empirical strategy

Occupational accidents are critical events resulting both from a random component, which is almost unpredictable and difficult to eradicate, and by the endogenously determined individual behaviours of the employer and the employee. As a result, a serious potential bias in estimating the effect of occupational injuries on labour market outcomes may result from time-invariant unobserved heterogeneity.

The theoretical literature identifies several factors giving rise to heterogeneity. Differences in the propensity to suffer workplace accidents and in the ability to avoid occupational risks may induce workers to look for jobs according to their risk aversion. Risk-averse workers may look exclusively for low-risk jobs, while high-risk individuals may be more willing to trade risk for wage, choosing jobs that induce them to assume dangerous occupational risks in exchange for higher wages. According to Lanoie (1991), endogenous selection may also be induced by employers, if they choose to overprovide safety precautions to compensate for the workers' hidden actions in exerting precaution effort.

Endogenous selection in risk at work may thus lead to biased estimates of the determinants of the probability of accidents and of their economic consequences. Specifically, if occupational sorting were random, accidents at work would be less rare, especially among low-risk individuals.

Evaluating the direction of bias introduced by the presence of heterogeneity is made difficult by two opposing effects. Unobserved heterogeneity may lead to underestimation of the effect of serious accidents on labour-market outcomes because low-risk individuals, who have higher probabilities of receiving *IIDB* without any job sorting, may also be those who experience the highest economic costs. This hypothesis is based on the assumption that individuals who are more risk-averse due to characteristics such as health conditions or abilities to adapt to occupational risks may be prone to slower recovery after a serious occupational accident. Conversely, the effects of a serious accident at work on labour outcomes would be overestimated if the most serious consequences were generally suffered by high-risk individuals. This assumption is plausible if accidents at work affect more, and with more serious consequences, workers in high-risk jobs and with low precaution efforts. This means that low-risk individuals may be less affected by earnings losses because of the precautionary effort that they make to avoid serious occupational accidents. In addition, the presence of wage compensation mechanisms may contribute to overestimation of the effect of a serious accident. High-risk workers, who are more willing to accept contracts with wage compensation mechanisms, may experience larger earnings losses because they are unable to trade wage for risk. In light of these considerations, particular care must be taken in choosing the appropriate estimation strategy for evaluation of the impact of accidents at work on labour-market

[24] My hypothesis was that differences in occupation, industry and number of employees implied that the worker had changed his/her job with respect to the previous period. The disadvantage of this empirical strategy was the impossibility of capturing job moves that occurred within occupations, industries and number of employees.

outcomes. Specifically, it is necessary to control for unobserved heterogeneity that may affect the estimates.

My empirical analysis treated the probability of employment and hourly wage separately. Although it could be correctly argued that workers' choices in the labour market result from the interdependence between these two factors, for the sake of simplicity I chose to investigate them separately. In Section 6, however, I discuss possible implications of this relationship for my empirical results.

I started by focusing on how an occupational injury affects the worker's employment status, namely the probability of employment. Given the dichotomous nature of the dependent variable E_{it}, I used a binary outcome model, with the following specification:

$$E_{it}^{*} = \alpha_i + X_{it}'\beta + \delta Injury_{it} + \varepsilon_{it} \qquad [1]$$

$$E_{it} = \begin{cases} 1 & if\ E_{it}^{*} > 0 \\ 0 & otherwise \end{cases}$$

where E_{it}^{*} is the latent variable, which assumes a positive value if individual i is employed at time t and zero otherwise; X_{it} is a vector of control variables related to personal characteristics, time and regional dummies; α_i are the random variables that capture unobserved heterogeneity; and ε_{it} is the error term, which is logistic distributed.

The presence of time invariant unobserved heterogeneity suggested the use of a fixed effects estimator to isolate the causal effect of accidents at work from time-invariant unobserved heterogeneity between injured and non-injured individuals, which was captured by the random variable α_i. I therefore used the conditional fixed effects estimator presented in Chamberlain (1980).[25]

$Injury_{it}$ was the term of interest, which I proxied in different ways to explore the effect of accidents at work on the probability of employment. In the first model, $Injury_{it}$ was measured by the dummy variable $IIDB_{it}$, which identified whether the individual i received the *IIDB* at time t as the consequence of a serious occupational accident. This specification had the purpose of highlighting the immediate effect of the health shock due to the occurrence of the injury.

In a second specification, I accounted for the possible time lag between the occurrence of a state of injury and the effects on labour market outcomes. More specifically, in place of the variable at the time of the interview, I estimated the delayed effect of the shock including the $IIDB_i$ variable with a one-period lag, thus indicating whether the worker suffered an injury at time *t-1*.

Furthermore, in a third specification I included the $IIDB_i$ variables both at time t and at time *t-1* to estimate the cumulative effect. I assumed that the consequences of an occupational injury in a longer timespan are the composition of the effects at the time of the accident and the delayed ones.

[25] Given the large number of observations in the sample, restricting the sample size exclusively to individuals transiting from one labour status to the other does not constitute a serious problem. The main disadvantage of the conditional fixed effects estimator is the impossibility of estimating the marginal effects due to lack of information on individual heterogeneity (Wooldridge, 2001).

Finally, I report a fourth specification in which $Injury_{it}$ was measured by the number of years of injury. I included this variable, along with its squared term, to identify the effects of the deterioration in human capital due to a state of injury on the probability of employment. The number of years of injury may be a good proxy with which to highlight the deterioration in human capital. Differently from the $IIDB_i$ variables, the seriousness of an injury measures the worsening of the injured worker's health conditions,[26] which may reduce the worker's abilities and, thus, employment chances.

The second empirical analysis that I present explored whether an occupational injury induced variations in injured workers' earnings with respect to non-injured workers at time *t*[27] using the following specification:

$$ln\_yhrl_{it} = \alpha_i + X'_{it}\gamma + \vartheta Injury_{it} + \varphi_{it} \qquad [2]$$

where ln_yhrl_{it} is the hourly wage of individual *i* at time *t*, X_{it} is the vector of control variables including time varying personal characteristics, firm and job attributes (occupation, industry and number of employees at the workplace, characteristics of employment contract and presence of trade unions), and regional and time dummy variables. As in specifications [1], α_i is random variable capturing unobserved heterogeneity; φ_{it} is the error term, which is i.i.d. over *i* and *t*. To account for time-invariant unobserved heterogeneity, I estimated earnings losses with a fixed effects estimator.

Also in this case, to evaluate the immediate effect of the shock, in the first model, $Injury_{it}$ was measured by the dummy variable $IIDB_{it}$, which identified if the individual *i* was receiving the *IIDB* at time *t* as the consequence of a serious occupational accident.

In the second specification, I accounted for a possible time lag with the $IIDB_i$ variable at time *t-1* in place of the variable $IIDB_{it}$. In this case, an additional matter of concern was that, while analysing the delayed effect of an accident on hourly wage, I had to control for possible job moves in the given period (between time *t-1* and time *t*). Injured workers may change their jobs following an occupational accident for two reasons: first, they may not want to continue working in the firm where their accident occurred; second, they may be unable to perform the activities necessary for fulfilment of their job description. Thus, when investigating the presence of the time lag of injury on wage, I added in equation [2] a variable controlling for job moves from the previous to the current period.

I then estimated the cumulative consequences of the shock on earnings by adopting an approach similar to the one used for the probability of employment: that is, I included in the specification both $IIDB_i$ variables, at time *t* and at time *t-1*, while controlling for possible job moves, as explained above.

My final specification included the seriousness of accidents as an alternative proxy for evaluating the effects of an injury, in line with the last specification presented for the probability of employment. In this way, I accounted for the fact that earnings losses may vary with the

[26] I assumed that the injured worker did not know exactly when the state of injury would finish. Consequently, I may hypothesize that the accumulation of *IIDB* measures how an injury has worsened the injured worker's health conditions, even if, during this period, medical care would lead the worker to recovery from his/her injury.
[27] To estimate earnings losses, I restricted the sample to workers in paid employment.

duration of the accident-related injury. The reduction of productivity, directly related to the severity of the occupational injury, may significantly affect injured workers' earnings possibilities.

6. Empirical Results

Effects on employment probabilities

The results of the conditional fixed effects logit estimations on employment status are presented in Table 1.[28] The specifications presented differ as explained in the previous section: column (I) reports the result relative to the effect of an injury at time *t* on employment probabilities; column (II) I sets out the delayed effect of suffering an injury at time *t-1*; column (III) shows the cumulative consequences of an accident at work as the composition of the effects at the time of the accident and the delayed ones; finally, column (IV) displays how the seriousness of an injury affects the probability of employment.[29]

Estimating the immediate effect (column I) shows a negative and statistically significant correlation between a work-related injury and employment probabilities. In line with the descriptive statistics in Fig.2, workers suffering an injury in the current period have a lower probability of being employed than do non-injured workers. This evidence is consistent with the findings on the probability of employment generally reported by the empirical literature in this field.[30]

I also find that the negative and statistically significant effect associated with a state of injury persists in the period following the injury (column II). This relationship confirms the negative impact of a serious occupational accident on the probability of employment: injured workers who were still employed after the injury at time *t-1*[31] had lower probabilities of maintaining their occupations in the following period, compared with non-injured workers.

[28] These results have been tested by performing logit models with robust errors to gauge how ignoring unobserved heterogeneity may affect the estimations. By comparing the results of the logit and conditional fixed effect logit models, it can be shown that ignoring unobserved heterogeneity leads to overestimation of the effect of an accident at work on employment probabilities. This result suggests that high-risk individuals, who are more likely to experience a serious accident at work, also experience more severe consequences in terms of lower employment probabilities than do non-injured workers. The results are not reported here, but are available upon request.

[29] The table reports only the coefficients of interest, while the full set of results is available from the author upon request.

[30] The studies in the empirical literature (Biddle, 1998; Boden and Galizzi, 1998, 1999, 2003a; Reville, 1999; Reville and Schoeni, 2001; Reville et al., 2002; Woock, 2009a, 2009b) relatively to the US labour market and Crichton et al. (2011) and Butler et al. (2006), on, respectively, the New Zealand and Canada labour markets, find that earnings losses reported by injured workers after a serious occupational accident are largely explained by a decrease in the employment rate.

[31] Given the empirical strategy, the coefficient associated with an injury at time *t-1* captures variations in probabilities of employment of those who transit from one labour status to the other. The interpretation of the delayed effect varies according to the estimated value of the coefficient. A positive value of the coefficient may identify higher probabilities of returning to work among injured workers at time *t-1* after having lost their jobs in the previous period. By contrast, as in my results, a negative value of the coefficient captures an additional decline in employment probabilities for injured workers still employed after the injury at time *t-1*.

Table 1: Effects on employment probabilities - Conditional fixed effects logit estimations

	(I)	(II)	(III)	(IV)
$IIDB_t$	-0.8744*** (0.2641)		-0.6179** (0.2948)	
$IIDB_{t-1}$		-0.6846** (0.3019)	-0.5342* (0.3135)	
Seriousness				-0.3126*** (0.1254)
Seriousness Square				0.0012 (0.0122)
Personal Characteristics	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Log likelihood	-14881.492	-11709.14	-11706.953	-14873.694
Number of observations	43464	34447	34447	43464
Number of groups	5168	4106	4106	5168

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition.

When I focus on the composition of the immediate effect and the delayed one, I note that suffering an injury in the current period has a stronger negative effect on employment probabilities than an injury at time *t-1* (column III). An accident resulting in a serious injury has negative and immediate consequences on employment probabilities. However, the statistically significant effect of having suffered a state of injury at time *t-1* also highlights the difficulties in returning to work faced by injured workers who lost their job in the previous period. Thus confirmed is the existence of a negative delayed effect on the probabilities of employment in the period following the injury.

The negative effect of the occurrence of a work-related injury is confirmed when I investigate the role of the severity of an injury on employment status. The results show that employment probabilities decrease monotonically with the worsening of the injured worker's health conditions measured in terms of years of work-related injury. There is a negative and statistically significant effect of the seriousness on employment probabilities, but the coefficient associated with its squared term is statistically equal to zero. This evidence confirms that returning to work is harder for those workers who receive the *IIDB* for two or more years.

My analysis cannot as such inform on the cause of the negative relation between injuries and employment probabilities, but I can speculate on what is the most likely mechanism at work. Following an injury, a worker may be unable to carry out pre-injury tasks. The results support the idea that employers and local labour markets do not provide alternative jobs that are suited to injured workers' limited abilities. They may be induced to leave their employment, especially in the case of heavy-duty jobs or long working hours, because accidents at work have reduced their productivity. The findings thus imply that employment probabilities are negatively affected by losses of human capital due to occupational injuries. Indeed, when these losses are larger as a consequence of more serious work-related injury, the deterioration in employment probabilities is higher (column IV). The inability of employers to provide an alternative job suited to injured workers' reduced abilities may be due to the firm's size or to limited job protection. The decrease in human capital puts injured workers at a disadvantage when seeking employment in the local labour market. This is particularly the case when there are no appropriate jobs for workers with work-limiting disability, and it may thus prove to be more difficult for injured workers to find jobs suited to their abilities.

An alternative explanation of the negative relationship between accidents at work and employment probabilities is that employers are not willing to hire high-risk individuals that are injured too frequently and too seriously. The costs associated with workplace injuries are high

for firms, and they increase with the number of occupational accidents and their severity: for example, higher premiums paid to the national social security system, costs incurred to replace workers and damaged products, structures or equipment. This is especially the case in times of recession or when the unemployment rate is particularly high. According to the theoretical literature on risk at work,[32] one of the labour-market failures related to risk at work is due to asymmetric information on the heterogeneity in the worker's propensity to be injured and to apply for medical care. Employers may use the occurrence of a state of injury, certified by the *IIDB*, as a signal not to hire injured individuals in order to respond to the adverse selection problem.

A final possible explanation of the negative relation between job injuries and employment probabilities concerns the economic incentives that injured workers face when deciding whether to return to work.

The presence of several benefits besides the *IIDB*, such as the *Reduced Earnings Allowance (REA)*, the *Constant Attendance Allowance (CAA)* and the *Exceptionally Severe Disablement Allowance (ESDA)*, may induce injured workers to postpone or avoid returning to work, thus negatively affecting their employment probability. Indeed, as argued by Boden and Galizzi (2003b), the existence of economic incentives may decrease the probability of returning to work.

A possible disincentive for returning to work is the depreciation of the post-injury wage. If this is lower than the reservation wage, a worker may postpone or avoid returning to work, especially if s/he has left the pre-injury job and is now looking for a new one. The absence of an alternative job suited to the injured workers' reduced abilities and paying an amount in line with their reservation wage may lead to permanent labour-market exit.

Given the data limitations, it has only been possible to test if effects on the probability of employment are due to inadequacy of the macroeconomic conditions of the local labour market. I could proxy the state of the local labour market, with respect to the national average, by using information on the regional unemployment rate and on the regional GDP, measured per inhabitant and adjusted for purchasing power parity.[33] According to my hypothesis, an injured worker may experience more difficulties in obtaining a more suitable job in a local labour market affected by a higher level of unemployment rate or by a lower level of GDP with respect to the national average.

Table 2 reports the results of the disaggregate analyses by macroeconomic conditions of the regional labour market.[34] Columns (I) and (II) show the results for the subsamples of workers in regions where the unemployment rate is respectively below and above the country average.

[32] Rothschild and Stiglitz (1976), Wilson (1977), Grossman (1979) and Crocker and Snow (1985) suggest that the occurrence of accidents at work and the corresponding costs may be explained by labour market failures due to asymmetric information problems. In this respect, there are two main sources of misinformation: the heterogeneity in the worker's propensity to take risks and the lack of information on precaution levels exerted by either the worker or the employer.

[33] Data on the unemployment rates (from 1992 to 2008) and gross domestic product (from 1995 to 2008), at both national and regional levels, are provided by the Labour Force Survey (LFS).

[34] For the disaggregate analyses, I created a dummy variable equal to 1 if the regional unemployment rate was higher than the national average and 0 otherwise, and a dummy variable identifying whether that region's GDP was higher than the average. Empirical analyses were performed using the third specification of equation [1] in order to identify the immediate effect ($IIDB_t$), the delayed effect ($IIDB_{t-1}$), and the cumulative effect.

Columns (III) and (IV) report the results for workers in regions where GDP is respectively below and above the country average.

Table 2: Effects on employment probabilities – Disaggregate analyses by macroeconomic conditions

	Below-average Unemployment Rate		Above-average Unemployment Rate		Below-average GDP		Above-average GDP	
$IIDB_t$	0.6555	(0.4551)	-1.4413***	(0.5400)	-0.9152***	(0.3312)	0.6249	(0.9567)
$IIDB_{t-1}$	-0.2549	(0.4437)	-0.8361	(0.6634)	-0.6381**	(0.3489)	-0.3941	(1.1669)
Personal Characteristics	Yes		Yes		Yes		Yes	
Regional dummies	Yes		Yes		Yes		Yes	
Time dummies	Yes		Yes		Yes		Yes	
Log likelihood	-5186.319		-4020.310		-8851.309		-1788.634	
Number of observations	15207		11630		26072		5278	
Number of groups	2221		1904		3367		716	

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition.

The results confirm my hypothesis on the relationship between the inadequacy of local labour markets and the effects of a work-related injury on employment probabilities. The lack of any statistically significant effect in regions where the unemployment rate is below the country average (column I) or GDP is above the country average (column IV) highlights that the negative consequences of an occupational injury may be mitigated when local labour markets supply jobs better suited to injured workers' limited abilities. By contrast, injured workers are particularly penalized in regions affected by high unemployment rates and low levels of GDP per inhabitant. Here appropriate jobs for workers with work-limiting disabilities are rare, or they may be assigned to non-injured unemployed workers. The negative and statistically significant effect of a work-related injury on employment probabilities confirms the existence of scant opportunities to return to work in labour markets characterized by deprived conditions in terms of unemployment rate and GDP per inhabitant.

These results also bear out the hypothesis that, following an injury, a worker may exit the job market permanently because the post-injury wage is below the reservation wage. In those regions where the macroeconomic conditions are worse and the labour-market supply is higher, employers may be more inclined to offer very low wages for jobs that could be feasible for injured workers as well. A lower post-injury wage would increase the workers' incentive to choose benefits such as *REA, CAA* and *ESD* rather than actively return to the labour market.

Effects on hourly wages

The results[35] relative to the effect of work injury on hourly wages are presented in Table 3.[36] Mirroring the analysis on employment probabilities, in column (I), I report the estimated differences in hourly wages between injured and non-injured workers; column (II) shows the results relative to the delayed effects; column (III) shows the cumulative effect of a work-related

[35] Given the definition of the dependent variable, I tested the robustness of my findings by controlling for the role of hours worked. In detail, I performed this test in two ways: including in equation [2] hours worked per week as a control variable and using annual labour earnings instead of the hourly wage. The results were robust to the inclusion of the variable capturing the number of hours worked per week and to different definitions of labour earnings. The lack of significant differences between these specifications and the main models highlights that variations in hours worked do not affect my findings. The results are not reporter here, but are available upon request.

[36] In regard to the effect of unobserved heterogeneity, my analysis confirmed the hypothesis discussed above: the presence of time invariant unobserved heterogeneity may overestimate the effect of injury on earnings. This result seems to suggest that, in the event of an accident at work, high-risk individuals may suffer more serious economic consequences in terms of employment opportunities and earnings losses.

injury; finally, column (IV) displays how the seriousness of an occupational accident affects hourly wages.

An occupational injury does not have immediate effects on hourly wages (column I). The coefficient associated with the *IIDB* variable at time *t* is not statistically different from zero. This result counters the hypothesis that an accident may give rise to immediate costs in terms of hourly wages reduction for injured workers with respect to non-injured workers.

However, column (II) shows that injured workers incur delayed indirect costs in terms of wage penalties. I find that suffering an occupational injury at time *t-1* negatively affects earnings at time *t*: the reduction of the hourly wage compared with that of non-injured workers in the same period is statistically significant and equal to 8.27 per cent. This result highlights that workers who have suffered an occupational injury in the recent past are penalized in the current period with respect to non-injured workers.

The results shown in column (III) suggest that the cumulative effect of a serious accident on wage-earning capacity is mainly determined by the delayed effect of suffering a state of injury in the previous period. A worker injured at time *t-1* and time *t* faces a decline in his/her hourly wage equal to 9.21 per cent with respect to that of non-injured workers, and the delayed effect (the $IIDB_t$ variable at time *t-1*) accounts for 84.8 per cent of the total differential.[37]

Table 3: Effects on hourly wages – Fixed effects estimations

	(I)		(II)		(III)		(IV)	
$IIDB_t$	-0.0300	(0.0451)			-0.0140	(0.0392)		
$IIDB_{t-1}$			-0.0827**	(0.0371)	-0.0781**	(0.0392)		
Seriousness							-0.0677***	(0.0245)
Seriousness Square							0.0055**	(0.0029)
Personal characteristics	Yes		Yes		Yes		Yes	
Firm and job characteristics	Yes		Yes		Yes		Yes	
Change of jobs	-		Yes		Yes		-	
Regional dummies	Yes		Yes		Yes		Yes	
Time dummies	Yes		Yes		Yes		Yes	
R-squared	0.2592		0.3093		0.3093		0.2593	
Number of observations	89845		71373		71373		89845	
Number of groups	15356		11862		11862		15356	

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition. Firm and job attributes are occupation, industry, public/private firm, number of employees at the workplace, type of contract (part time/full time, and indefinite/temporary) and presence of trade unions.

In column (IV) I explore how wage penalties are related to a deterioration of the injured worker's health conditions, captured by the seriousness of the injury. Performing the fourth specification highlighted that the accumulation of years of work-related injury has a negative and statistically significant effect on the hourly wage. The positive and statistically significant coefficient associated with its squared term indicates a marginally increasing negative effect. These results underline that the negative and statistically significant effect of an injury increases with its persistence. They imply that accidents at work causing a state of injury for two years are associated with a 11.34 per cent penalty in the hourly wage. In regard to earnings losses, therefore, a representative injured worker[38] faces an annual earnings loss of £2,386. One

[37] The statically significant effect of the cumulative effect, in terms of the sum of the immediate and the delayed effect, was tested with a F-test, and the null hypothesis was rejected.

[38] A representative individual is a married worker, between 30 and 45 years old, employed in a small privately-owned manufacturing firm, resident in Inner or Outer London. S/he is employed in a high-skilled occupation on a full-time permanent labour contract.

additional year of injury brings the differential to 15.35 per cent, with annual earnings losses for the average worker estimated at £3,976. Receiving the *IIDB* for four years reduces the hourly wages of injured workers by 18.26 per cent, increasing the average annual earnings losses to £5,302. Finally, extremely serious occupational accidents, which entail a state of injury for five or more years, are associated with a larger wage penalty of up to 20.73 per cent with respect to that of non-injured workers. Accidents with at least five years of injuries entail more than six thousand pounds of annual earnings losses.

The existence of consistent and stable losses in wages for injured workers is in direct contrast with the hypothesis that the earnings losses of injured workers are only a consequence of a decrease in post-injury employment, and that they vanish on returning to stable employment (Butler et al., 2006). On the contrary, my findings are in line with results reported by Reville and Schoeni (2001) and Woock (2009a) for the US labour market, and Crichton et al. (2011) for New Zealand. These contributions identify a positive relationship between the seriousness of an occupational accident and earnings losses.

As in the case of employment probabilities, the empirical estimation does not inform on the reasons why injured workers experience earning losses. There are a number of possible explanations for this.

A worker may experience a significant decrease in human capital in terms of lower productivity as a result of an occupational injury. The decrease in productivity may lead to a greater decline in wage-earning capacity, especially when the employer adopts physically demanding pay-for-performance mechanisms. The widespread use of these incentive practices may explain part of the estimated wage gap because they imply effects on incentives and the sorting of workers with different characteristics (Lazear, 2000; Paarsch and Shearer, 2000). Injured workers may not be able to exert sufficient effort to fulfil the productivity targets required by such incentive practices; moreover, injured workers may prefer to sort into firms that do not use these mechanisms and with less occupational risks, obtaining lower hourly wages in exchange.

I tested this hypothesis with disaggregated analyses using information on the employer and on the presence of trade unions at the firm.[39] In Table 4 I report results for workers in private and public firms (columns I and II, respectively) and for unionized and non-unionized workers (columns III and IV, respectively). These groups of workers differ in various respects. First, they may be subject to very different working conditions implying different propensities to workplace accident. Second, in private and non-unionized firms, workers are more likely to be employed on pay-for-performance contracts, which may provide less protection against variations in productivity and the business cycle. According to Burgess and Ratto (2003) and Prentice, Burgess and Proper (2007), in Great Britain very few pay-for-performance mechanisms are used in the public sector. Several studies (Brown, 1990; Heywood et al., 1997; and Barth et al., 2008) underline that unionized enterprise disfavours the use of such mechanisms.

[39] For the disaggregate analyses, I performed the third specification of equation [2] in order to identify the immediate effect ($IIDB_t$), the delayed effect ($IIDB_{t-1}$), and the cumulative effect (the sum of the immediate and the delayed effects).

Table 4 provides evidence that occupational injuries have negative and statistically significant consequences on hourly wages only in the private sector. The magnitude of the cumulative effect of a work-related injury, as the sum of the immediate and the delayed effect, is equal to 11.5 per cent. I find no statically significant effect on wages for workers in the public sector, not even in terms of the delayed effect. Similarly, I find no statistically significant effect on earnings for unionized workers (column III). This result is in line with Woock (2009b), who found no statistically significant difference between unionized injured and uninjured workers. My results suggest larger negative effects for workers in non-unionized firms, albeit with no statistical significance (column IV). The lack of any statistical significance on analysing injured workers in non-unionized firms seems to contradict the results of Woock (2009b), which show significant and persistent losses in the years following an injury among non-unionized injured workers. However, the absence of a statistically significant effect can be attributed in my case to the small number of injured workers in the sample.

Table 4: Effects on hourly wage – Disaggregated analyses

	Public firms	Private firms	Unionized firms	Non-unionized firms	Stayers	Movers
$IIDB_t$	-0.0092	-0.0229	0.0025	0.0138	0.0289	-0.0863
	(0.0725)	(0.0458)	(0.0516)	(0.0608)	(0.0435)	(0.0709)
$IIDB_{t-1}$	-0.0625	-0.0923**	-0.0259	-0.0842	-0.0815*	-0.0561
	(0.0734)	(0.0459)	(0.0538)	(0.0590)	(0.0472)	(0.0673)
Personal Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm and job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Change of jobs	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.3232	0.3088	0.3249	0.2857	0.3994	0.2457
Number of observations	23024	48349	33705	37668	39077	32296
Number of groups	4369	9131	7014	9217	9865	9520

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition. Firm and job attributes are occupation, industry, public/private firm, number of employees at the workplace, type of contract (part time/full time, and indefinite/temporary) and presence of trade unions.

The lesser frequency of pay-for-performance mechanisms in the public sector may explain the absence of any effect on wages. The role of trade unions in opposing contracts characterized by pay-for-performance mechanisms and in obtaining better working conditions accounts for the lack of any statically significant differences in earnings between injured and non-injured workers. A decrease in human capital has less negative impact on injured workers' earnings in the public sector and in unionized firms where pay-for-performance contracts and physically demanding working conditions are not widespread. Moreover, lower earnings losses in the public sector and in unionized firms may be the result of higher job and wage protection. The existence of the *Disability Discrimination Act* and the presence of trade unions in the bargaining process may guarantee that job opportunities and promotions are not reserved exclusively for non-injured workers, reducing discrimination against injured workers.

The existence of wage penalties also reflects the fact that employers may discriminate against injured workers either directly or indirectly. The direct effects of discrimination may be related to contract arrangements if employers hire injured workers on less attractive contracts. Moreover, employers may discriminate indirectly against injured workers by providing low work safety standards. As a result, injured workers may have to devote additional effort to

precaution activities, compared with the other workers, in order to avoid accidents. This is the case of particular work-related disabilities that restrict the type or the amount of work that injured workers are able to perform. Furthermore, excessively demanding productivity targets may result in an indirect form of discrimination. Injured workers may not be able to fulfil productivity targets, especially when these are demanding in terms of involvement and working hours.

Reductions in injured workers' human capital may distort job-worker matching and cause earnings losses. A decline in job-worker matching may occur whenever injured workers are unable to carry out their pre-injury jobs, especially in the case of physically or mentally demanding tasks. Moreover, job-worker matching may not be efficient whenever the employer does not supply an alternative job that suits the injured worker's limited abilities. This may happen more often when injured workers are highly specialized or when alternative jobs are not available in the firm due to the limited number of employees at the workplace. The existence of distortions in job-worker matching may drive injured workers to different jobs. More efficient job-worker matching may help minimize earnings losses by providing jobs better suited to injured workers' limited abilities. The positive effects of job moves may be mitigated by losses in terms of firm-specific human capital or tenure accrued over time.

The validity of this latter explanation can be tested empirically by looking at the wage penalties incurred by those workers still employed in their pre-injury jobs (*stayers*) and those workers who have moved to different jobs after the occurrence of occupational injuries (*movers*). The results are presented in columns (V) and (IV) of Table 4.

The results show a negative effect on earnings only for those workers who stay in their pre-injury jobs. Column (V) shows that the delayed effect, in terms of wage penalties for injured stayers, is 8.15 per cent. By contrast, workers who move to a different job after an occupational injury do not experience any statistically significant reduction in hourly wages with respect to non-injured workers. These results confirm the existence of distortions in job-worker matching that cause significant earnings losses as a consequence of a serious occupational accident. Moving to jobs better suited to the new and limited workers' abilities may mitigate these wage penalties. Moreover, the results of this separate analysis suggest that moving to a new and more suitable job can be interpreted as a voluntary decision by injured workers to improve post-injury job-worker matching.

Workers who return to work after injury thus belong to two categories. Some of them return to their pre-injury jobs and, as shown in my analysis, accept some wage penalty. In this case, I can speculate that workers adjust their reservation wage downwards because of, as argued by Galizzi and Zagorsky (2009), the increased financial need due to the costs of medical and rehabilitation care or to earnings losses suffered during the spell of the accident-related injury. These workers accept the pre-injury job with lower pay. Other workers decide to look for a more suitable job. I can think of these workers as those for whom the lower wage offered in the pre-injury job is now below the reservation wage. In their case, the reservation wage does not adjust downwards, and working in the pre-injury job is no longer acceptable for them.

In both these cases, pre-injury job-worker matching is distorted after the accident. What differs is the adjustment mechanism: in one case, workers adapt their expectations; in the other, they look for a better job matching.

Robustness check

Different estimations of the delayed effect on employment probabilities

Testing whether having suffered a work-related injury in the previous periods affects employment probabilities is particularly important for identifying the duration of the process of deterioration of an accident at work on labour market outcomes. I accordingly estimated the delayed effects of having suffered an occupational injury at times *t-2*, *t-3* and *t-4*. I tested the robustness of the findings, which highlighted the immediate effect, captured by the $IIDB_i$ variable at time *t*, as the main consequence of an injury on the probability of employment. Moreover, my hypothesis was that a further worsening of employment probabilities among injured workers could be identified only in the following period. Thus, this sensitivity analysis helped me to check whether differences in employment probabilities remain constant over time, confirming the difficulties of a return to work after a serious occupational accident.

The results are presented in Table 5, where I estimate separately the delayed effects of the two- (column I), three- (column II) and four-year lagged variables (column III). I found no statistically significant effect on investigating the effect on the probability of employment at time *t* of an injury suffered at times *t-2*, *t-3* and *t-4*.

My hypothesis was confirmed: the immediate effect of suffering a work-related injury has continued negative consequences on the probability of employment. Indeed, the lack of any statistically significant effects highlights the difficulties of returning to work at time *t* after a serious occupational injury suffered in the previous periods.

Table 5: Effects on employment probabilities – Higher lags

	(I)	(II)	(III)
$IIDB_{t-2}$	-0.1757 (0.3234)		
$IIDB_{t-3}$		0.1004 (0.3855)	
$IIDB_{t-4}$			0.2965 (0.4459)
Personal characteristics	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Log likelihood	-9221.311	-7237.611	-5629.876
Number of observations	27550	21991	17471
Number of groups	3361	2741	2258

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition.

Different estimations of the effects in a longer timespan and of the seriousness of an accident

My estimation strategy detected the existence of a significant delayed effect of suffering a serious occupational accident at time *t-1* on the hourly wage at time *t*. I tested the robustness of this result by looking at whether this effect persisted when I included higher lags of the $IIDB_i$ variable in the specification. Specifically, I used the $IIDB_i$ variable at times *t-2*, *t-3* and *t-4*, instead of the variable at time *t-1*.

The results are presented in Table 6, where I estimate separately the delayed effects of the two- (column I), three- (column II) and four-year lagged variables (column III). These results confirm the negative and statistically significant effect on the hourly wage at time *t* of an injury at times *t-2* through *t-4*. I find negative and statistically significant for time *t-2* and *t-4*. However, the coefficient associated with the $IIDB_i$ variable at time *t-3* is not statistically significant.

These results suggest that the magnitude of the cumulative effect should be redefined by including the lagged variables relative to suffering a work-related injury at times *t-2*, *t-3* and *t-4* in the third specification of equation [2]. The results, reported in column (IV), confirm the existence of a statistically significant cumulative effect on the hourly wage[40] mainly due to suffering an occupation injury at time *t-2*. With this empirical strategy, an accident at work resulting in a state of injury at time *t, t-1* and *t-2* entails a wage penalty equal to 9.55 per cent. Differences in wages increase to 13.95 per cent if I consider an accident at time *t-3* which results in a state of injury for four periods (time *t, t-1, t-2* and *t-3*). Finally, if I consider a worker injured for five consecutive periods (time *t, t-1, t-2, t-3* and *t-4*), I find that earnings losses are equal to 21.55 per cent with respect to those of uninjured workers. The results are generally in line with my speculations on how wage penalties increase with the seriousness of an injury.

Table 6: Effects on hourly wages – Higher lags

	(I)	(II)	(III)	(IV)
$IIDB_t$				0.0273 (0.0486)
$IIDB_{t-1}$				-0.0214 (0.0505)
$IIDB_{t-2}$	-0.0732* (0.0395)			-0.1014** (0.0500)
$IIDB_{t-3}$		-0.0523 (0.0424)		-0.0440 (0.0480)
$IIDB_{t-4}$			-0.1075** (0.0457)	-0.0760 (0.0477)
Personal characteristics	Yes	Yes	Yes	Yes
Firm and job characteristics	Yes	Yes	Yes	Yes
Change of jobs	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-squared	0.2862	0.2692	0.2534	0.2536
Number of observations	61985	52074	43694	43694
Number of groups	10436	9118	7959	7959

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition. Firm and job attributes are occupation, industry, public/private firm, number of employees at the workplace, type of contract (part time/full time, and indefinite/temporary) and presence of trade unions.

An alternative strategy with which to test the effect of the seriousness of an accident at work on hourly wage is to analyse separately the effects relative to the persistence of the injury. This strategy makes it possible to test further whether the persistence of an injury leads to increasing differences in hourly wages over time. The persistence of the injury is captured by accidents that have caused a state of injury for two or more consecutive years up to the current period. For instance, the persistence of an injury suffered at time *t-1* is estimated by constructing a dummy variable equal to 1 if and only if injured workers receive the *IIDB* also at time *t*, and 0 otherwise. On performing this analysis, I hypothesised that the seriousness of an accident increases with the persistence of injury, since I did not have a measure capturing the degree of injury certified by a qualified doctor. The variable constructed to estimate the persistence of two consecutive periods of injury in affecting hourly wage was included in the second specification instead of the lagged variable capturing an injury suffered at time *t-1*. For each of the previous

[40] The significance of the cumulative effect was confirmed with a F-test conducted by considering, together with the variable $IIDB_{it}$, the lagged variables relative to injuries suffered at times *t-1, t-2, t-3* and *t-4*.

periods (time *t-2*, *t-3* and *t-4*), I followed a similar strategy in constructing variables that captured the persistence of the injury.

Table 7: Effects on hourly wages – The persistence of an accident

	(I)	(II)	(III)	(IV)
IIDB at time *t-1* and *t*	-0.1172** (0.0491)			
IIDB at time *t-2*, *t-1* and *t*		-0.1550** (0.0585)		
IIDB at time *t-3*, *t-2*, *t-1* and *t*			-0.1852*** (0.0699)	
IIDB at time *t-4*, *t-3*, *t-2*, *t-1* and *t*				-0.2217** (0.0866)
Personal characteristics	Yes	Yes	Yes	Yes
Firm and job characteristics	Yes	Yes	Yes	Yes
Change of jobs	Yes	Yes	Yes	Yes
Regional dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
R-squared	0.3094	0.2863	0.2692	0.2534
Number of observations	71373	61985	52074	43694
Number of groups	11862	10436	9118	7959

Note: * Significant at 0.100; ** Significant at 0.50; *** Significant at 0.01. Standard errors are in parentheses. Personal characteristics are age classes and family composition. Firm and job attributes are occupation, industry, public/private firm, number of employees at the workplace, type of contract (part time/full time, and indefinite/temporary) and presence of trade unions.

The estimations of the effect of the persistence of injury are presented in Table 7. Negative and statistically significant effects of the variables relative to persistent occupational injuries provide more evidence that wage penalties affect workers more severely according to the duration of the injury. Although the results obtained with this strategy of analysis are higher than the corresponding effects summarizing estimations in column (IV), they define a similar trend. With the worsening of health conditions, captured by more persistent injuries, wage penalties increase. They rise from 11.72 per cent, considering a state of injury suffered at time *t* and *t-1*, to 22.17 per cent, referring to serious occupational accidents that entail a state of injury for at least four periods.

7. Concluding remarks and policy implications

The foregoing analysis has investigated the effects of accidents at work on labour-market outcomes. First, I focused on employment probabilities. I showed that injured workers have a higher probability of losing their jobs compared with non-injured workers following an injury, but also in the year after suffering the injury. They have only few chances of returning to work in the periods following the accident. A negative and monotonous relationship between the duration of the injury and employment probabilities confirms these findings. The results are in the line with the hypotheses that workers are no longer able to carry out pre-injury tasks, and that alternative jobs suited to injured workers' new and limited abilities are not available. Moreover, this outcome may also result from the presence of economic incentives such as *REA*, *CAA* and *ESD* or by a post-injury wage lower than the reservation wage, which may induce injured workers not to return to work. A geographically disaggregated analysis showed that this effect is statistical significant only in regions characterized by high unemployment rate and low GDP per inhabitant, where competition for jobs with non-injured workers is stronger.

Second, I focused on injured workers still employed after an accident. I showed that there is a time lag between the occurrence of a state of injury, as a consequence of an accident at work, and the effects on wage-earning capacity. While the immediate effect of injury on wages is

insignificant, a delayed effect is present. Specifically, the cumulative difference in hourly wages between injured and non-injured workers is equal to 9.21 per cent, and 84.8 per cent of the total differential can be attributed to having suffered an injury further back in time. The negative impact of a serious accident increases with the duration of the injury. My results highlight that, in the presence of an extremely serious accident, the difficulties of returning to work after an occupational accident are heightened, and wage penalties rise up to 20.73 per cent, with the consequence of annual earnings losses, for a representative injured worker, estimated at more than six thousand pounds. Various factors can explain this disparity in wages. A decline in productivity may increase the wage penalties for injured workers, especially in firms where physically demanding pay-for-performance mechanisms are used. Conversely, an accident at work has an insignificant effect on the hourly wage in the public sector and in unionized firms, which are characterized by high job and earnings protection. Differences in earnings may also be the result of discrimination practices, since injured workers may be disfavoured in employment opportunities and earnings. Reductions in human capital may distort job-worker matching and cause earnings losses for injured workers. I tested this last explanation, finding that injured workers' earnings losses may be minimized if they move to new and alternative jobs better suited to their limited abilities.

These findings have various important policy implications. The high costs associated with occupational injuries in the British labour market call for incentive-compatible regulation able to prevent accidents at work and minimize their negative consequences for workers' health. Although accidents at work are unforeseeable random shocks, regulating safety at work, with stringent employers' and workers' duties or favouring the *Workplace Health Promotion (WHP) programme*, can contribute to reducing occupational risks. Higher standards for safety at work may prevent occupational accidents and reduce the duration of absence, thus limiting the economic consequences.

In the event of accidents at work, governments should design schemes to prevent the substantial reduction in career opportunities and earnings associated with a decline in human capital. However, the costs and benefits of these interventions should be carefully assessed. One possible measure would be the introduction of financial aid intended to facilitate job placements suited to the workers' health conditions and productivity. A policy of this kind would prevent the long-term unemployment of injured workers, particularly in regions where macroeconomic conditions are worse, and it would improve post-injury job-worker matching. This intervention might be effective if the government offsets employers' costs in hiring injured workers (higher insurance premiums for medical care, costs of setting and maintaining high occupational health and safety standards, providing special training courses, etc.). Moreover, such a policy could reduce the unemployment probabilities and earnings losses of injured workers if it is designed to provide allowances inducing injured workers to move to more suitable jobs, thus increasing post-injury job-worker matching.

Government interventions should also be aimed at increasing job and employment protection to levels similar to those in the public sector and unionized firms. The prosecution of any employer discriminating against injured workers should also be a key component of public policy. Disfavouring contracts that introduce physically demanding pay-for-performance mechanisms may reduce the earnings losses suffered by injured workers. Accordingly, interventions aimed at

promoting equality of opportunity for injured and non-injured individuals, such as the *Equality Act 2010* and the *Disability Equality Duty (DED)*, are to be recommended.

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Appendix

Table A1: Data description (Standard errors are in parentheses)

		Entire sample		Subsample of employed workers	
Dependent Variables	employment	0,7952	(0,4036)		
	ln_yhrl			1,9241	(0,7468)
	$IIDB_t$	0,0034	(0,0581)	0,0021	(0,0459)
	$IIDB_{t-1}$	0,0032	(0,0568)	0,0020	(0,0447)
	Seriousness	0,0213	(0,3642)	0,0133	(0,2443)
	Seriousness Square	0,1331	(3,9099)	0,0598	(1,9283)
Personal Characteristics	Age 16-30	0,3194	(0,4663)	0,2966	(0,4568)
	Age 31-45	0,3445	(0,4752)	0,4081	(0,4915)
	Age 46-65	0,3360	(0,4724)	0,2952	(0,4562)
	Single	0,3278	(0,4694)	0,2770	(0,4475)
	One or more children	0,3145	(0,4643)	0,3653	(0,4815)
Firm and job attributes	Occupation - Manager			0,1372	(0,3441)
	Occupation - Professional			0,1252	(0,3309)
	Occupation - Technicians			0,1369	(0,3437)
	Occupation - Clerical workers?			0,1805	(0,3846)
	Occupation - Service workers			0,1616	(0,3681)
	Occupation - Skilled agriculture workers			0,0072	(0,0846)
	Occupation - Trade workers			0,0971	(0,2961)
	Occupation - Machine operators			0,0821	(0,2745)
	Occupation - Elementary workers			0,0722	(0,2588)
	Industry - Agriculture			0,0097	(0,0980)
	Industry - Manufacturing			0,1995	(0,3996)
	Industry - Electricity			0,0097	(0,0981)
	Industry - Construction			0,0427	(0,2021)
	Industry - Wholesale			0,1428	(0,3499)
	Industry - Hotel			0,0439	(0,2049)
	Industry - Transport			0,0600	(0,2376)
	Industry - Finance			0,0512	(0,2205)
	Industry - Real Estate			0,0916	(0,2885)
	Industry - Public Administration			0,0828	(0,2756)
	Industry - Education & Health			0,2021	(0,4016)
	Industry - Other industry			0,0639	(0,2445)
	Establishment dimension - 1-49 employees			0,4752	(0,4994)
	Establishment dimension - 50-99 employees			0,1178	(0,3224)
	Establishment dimension - 100-499 employees			0,2338	(0,4233)
	Establishment dimension - more than 500			0,1732	(0,3784)
	Presence of trade unions			0,4641	(0,4987)
	Private firm			0,6863	(0,4640)
	Permanent contract			0,9530	(0,2117)
	Fixed term contract			0,0239	(0,1528)
	Temporary contract			0,0231	(0,1503)
	Part time job			0,1876	(0,3904)
Regional dummies	North East	0,1006	(0,3008)	0,1004	(0,3006)
	North West	0,0869	(0,2817)	0,0868	(0,2816)
	Yorkshire and The Humber	0,0267	(0,1611)	0,0271	(0,1623)
	East Midlands	0,0707	(0,2563)	0,0708	(0,2565)
	West Midlands	0,0718	(0,2582)	0,0707	(0,2563)
	East	0,0323	(0,1767)	0,0324	(0,1771)
	London	0,0742	(0,2621)	0,0734	(0,2607)
	South East	0,1542	(0,3611)	0,1597	(0,3663)
	South West	0,0716	(0,2579)	0,0729	(0,2600)
	Wales	0,1395	(0,3464)	0,1329	(0,3394)
	Scotland	0,1716	(0,3770)	0,1729	(0,3782)
Time dummies	1991	0,0483	(0,2144)	0,0496	(0,2172)
	1992	0,0464	(0,2104)	0,0142	(0,1183)
	1993	0,0448	(0,2070)	0,0441	(0,2054)
	1994	0,0446	(0,2063)	0,0451	(0,2076)
	1995	0,0435	(0,2039)	0,0445	(0,2063)
	1996	0,0453	(0,2080)	0,0468	(0,2112)
	1997	0,0511	(0,2202)	0,0534	(0,2249)
	1998	0,0498	(0,2176)	0,0534	(0,2248)
	1999	0,0715	(0,2576)	0,0720	(0,2585)
	2000	0,0723	(0,2590)	0,0736	(0,2611)
	2001	0,0704	(0,2559)	0,0731	(0,2603)
	2002	0,0621	(0,2413)	0,0644	(0,2455)
	2003	0,0615	(0,2403)	0,0635	(0,2439)
	2004	0,0586	(0,2349)	0,0616	(0,2404)
	2005	0,0587	(0,2350)	0,0611	(0,2395)
	2006	0,0592	(0,2360)	0,0623	(0,2418)
	2007	0,0570	(0,2319)	0,0604	(0,2382)
	2008	0,0548	(0,2276)	0,0568	(0,2315)
N. observations		120696		89845	

Table A2: Descriptive statistics

		Employment	Hourly wage
Personal Characteristics	Age 16-30	0,7452	6,4675
	Age 31-45	0,9357	9,6115
	Age 46-65	0,6986	9,3386
	Married	0,8519	9,1566
	Single	0,6790	7,1415
	No children	0,7376	8,1999
	One or more children	0,9206	9,2907
Firm and job attributes	Occupation - Manager		12,4311
	Occupation - Professional		12,9248
	Occupation - Technicians		9,9175
	Occupation - Clerical workers?		6,7098
	Occupation - Service workers		5,5675
	Occupation - Skilled agriculture workers		5,4738
	Occupation - Trade workers		8,0297
	Occupation - Machine operators		7,0882
	Occupation - Elementary workers		5,6114
	Industry - Agriculture		5,8055
	Industry - Manufacturing		8,7010
	Industry - Electricity		10,5127
	Industry - Construction		8,8866
	Industry - Wholesale		6,2176
	Industry - Hotel		4,8551
	Industry - Transport		8,7284
	Industry - Finance		10,9617
	Industry - Real Estate		10,3426
	Industry - Public Administration		10,1369
	Industry - Education & Health		9,3535
	Industry - Other industry		7,2097
	Establishment dimension - 1-49 employees		7,5074
	Establishment dimension - 50-99 employees		8,9569
	Establishment dimension - 100-499 employees		9,3424
	Establishment dimension - more than 500		10,3430
	Presence of trade unions		9,4848
	Absence of trade unions		7,8306
	Public firm		9,5922
	Private firm		8,1440
	Permanent contract		8,7005
	Fixed term contract		7,9479
	Temporary contract		5,0634
	Full time job		8,9748
	Part time job		6,9684
Regional dummies	North East	0,7926	7,7445
	North West	0,7953	8,4245
	Yorkshire and The Humber	0,8112	7,9072
	East Midlands	0,7959	7,7784
	West Midlands	0,7878	7,9718
	East	0,7944	10,6315
	London	0,8322	9,4035
	South East	0,8191	8,1845
	South West	0,7448	8,2724
	Wales	0,7940	8,8499
	Scotland	0,8008	7,8012
Time dummies	1991	0,7978	5,8259
	1992	0,7689	5,8760
	1993	0,7592	6,5638
	1994	0,7739	6,8090
	1995	0,7872	7,0348
	1996	0,7903	7,2443
	1997	0,8004	7,3996
	1998	0,8185	7,3850
	1999	0,7837	7,5802
	2000	0,7891	8,1268
	2001	0,7955	8,6003
	2002	0,8028	9,2401
	2003	0,7969	9,6492
	2004	0,8106	9,9924
	2005	0,8009	10,2323
	2006	0,8079	10,5238
	2007	0,8139	10,8429
	2008	0,8024	11,5409