Trends and Patterns in Occupational Health and Safety in Ireland

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Executive Summary

Occupational injuries and ill-health impose significant burdens on individuals, families, employers, the economy and society. Figures for 2011 reveal that 1.8 million working days were lost due to work-related injuries and illness. These figures dwarf the number of days lost through industrial action which tend to receive more prominence in the media and public debate (O'Halloran, 2014). In addition, between 2004 and 2013, 47 people on average lost their lives every year as a result of work-related accidents. Understanding the factors associated with occupational injury and ill-health is important in terms of prevention and in targeting interventions. This study addresses two central questions:

- How has the likelihood of experiencing a work-related injury or illness changed over the period 2001 to 2012?
- What factors are important in accounting for the risk of work-related injury and illness: e.g. work characteristics, personal characteristics and macro-conditions?

In this study, work-related injuries encompass any injuries incurred by workers in the course of their work ranging from minor injuries that did not involve any absence from work to the most serious injuries that result in worker fatalities. Work-related illness includes physical or mental health problems, that have been caused or made worse by work. The most common forms of work-related illness are musculoskeletal problems and stress, anxiety and depression. Over the period of the study, the former category accounted for just over half of all illnesses recorded, while stress, anxiety and depression accounted for a further 18 per cent.

Analysis is based on the data from annual modules on Work-Related Accidents and Illness that are collected by the Central Statistics Office (CSO) as part of the Quarterly National Household Survey (QNHS) and on data collected by the Health and Safety Authority (HSA) on fatal and non-fatal injuries based on employers' reports. These data provide a repeated snapshot of occupational injuries and ill-health over a 12-year period. While annual statistics have been drawn from these surveys, this is the first time that the data for all of the modules have been brought together and systematically analysed.[1] The survey is limited to those in employment during the previous 12 months and therefore those who have been unable to work or become unemployed due to work-related injuries or ill-health are not included. This process of selection is known as the 'healthy worker effect'

[1] We are extremely grateful to Felix Coleman at the CSO for his work in preparing the data.

and can only be disentangled through the analysis of longitudinal or work history information. Similarly, earlier exposures that have damaged a worker's health are not captured, even if those affected remain in employment.

1. TRENDS OVER TIME, FROM BOOM TO RECESSION

Our analysis covers an exceptionally volatile period in the Irish labour market including a period of exceptional growth (2001-2007) and of deep recession (2008-2012). These economic changes brought with them a shift in the sectoral distribution of employment, with the numbers employed in construction and retail showing the greatest swings. In addition to business-cycle changes there have also been long-term structural changes in the labour market such as the shift from manufacturing and farming to the service sector. The period also featured changes in the gender, nationality and age composition of the workforce. These factors are all relevant for the risk of injury and illness in the workplace. While the trends in such injury are monitored annually (through HSA statistical reports) there has been little analysis of the factors contributing to the pattern over time.

Trends are examined in two different ways. First, aggregate annual rates of injury and illness per 1,000 workers are calculated, using QNHS information on the incidence and on the numbers employed (by sector and gender).

- The injury rate fell from 29.6 per 1,000 workers in 2001 to 18.9 per 1,000 workers in 2012. This includes all injuries regardless of whether they resulted in an absence from work.[2]
- The illness rate increased from 21.7 per 1,000 workers in 2001 to 27.1 per 1,000 workers in 2012.
- The injury rate for men fell more rapidly than for women between 2001 and 2012, while the increase in the illness rate was more marked for women.
- Over the period the highest injury rates are found in five economic sectors: agriculture/forestry/fishing, industry, construction, transportation/storage and human health and social work activities. However due to relatively small numbers there is a good deal of fluctuation within sectors from one year to the next.

The second method uses the individual level data and pools years to investigate whether there are period effects when other relevant factors are controlled.

[2] Reportable injury rates, which involved absence of at least four days, are outlined in Chapter 2.

- Grouping the data into two periods, one representing the boom period (2001-2007) and the other covering the recession (2008-2012), we find that holding a wide range of factors constant, the recession period in Ireland was associated with a significantly *lower* probability of occupational injury and illness than the boom period.
- We also found the percentage annual employment change within sectors was positively associated with injury and illness risks; this confirms that work-related illness and injury rates are pro-cyclical.
- We tested whether this was due to the influx of inexperienced new recruits during periods of economic growth. Although injury risks are indeed highest in the first months of employment, even when those with job tenures of less than a year were excluded from the analysis, the odds of experiencing an accident remained higher in the boom period.
- While changes in the composition of the workforce contributed to the differences between boom and recession, it accounted for only a small part of the change. While shifts in occupations within sectors might also have contributed further to the explanation, there was no consistent measure of occupation available for the two periods to allow this analysis.
- Alternative explanations of the higher injury rates in the boom period relate to higher levels of activity/intensity, lower levels of supervision, and cutting corners to meet demand. These factors are not measured in the current data but suggest avenues for further investigation.
- Reluctance to report injuries or to take an illness absence during recessions may also contribute to the patterns observed. However, the results are based on answers to a household survey rather than on employer records, so this source of variation is reduced. Many of the illnesses and injuries reported in the survey did not result in absences.

These models test whether changes over time can be attributed to changes in workforce composition. Grouping years also minimises the problems associated with random fluctuations, given the relatively low number of cases of injury and illness recorded in each year.

2. WHAT FACTORS ARE ASSOCIATED WITH THE RISK OF WORK-RELATED INJURY AND ILLNESS

Worker Characteristics: Who is Most at Risk?

- Men are significantly more likely to experience work-related injuries than women. This result holds even when differences in working conditions (such

as hours of work) and sector are taken into account. This gender difference remains large when occupation is held constant.

- The odds of injury decrease with age. A lower injury risk for older workers may be due to greater job experience, lower risk-taking and to a selective reduction in involvement in heavy manual tasks.
- Non-Irish workers are less likely to experience work-related injury. This unanticipated finding may arise because of the heterogeneous composition of this group. When occupation is taken into account, for the period 2010-2012, there is no significant difference by nationality. The result may also be affected by the under-representation of the most vulnerable migrant workers in the QNHS survey or a greater reluctance among migrants to report injuries.
- There was no difference between men and women in the likelihood of work-related illness during the period of economic growth (2001-2007). In the recession period (2008 onwards), however, women were more likely than men to experience work-related illness.
- The likelihood of work-related illness increases with age. The age effect becomes weaker amongst the oldest age groups, as older workers with health problems retire earlier from employment.

Sectoral Influences

- The risk of work-related injuries is persistently higher in the following sectors: construction; Farming/forestry/fishing; human health and social work activities; and industry.
- The difference in the risk of injury in boom and recession is widest in the agricultural sector, the industry sector, the construction sector and the retail sector.
- The risk of occupational ill-health is greater in the agriculture, construction, transport and health sectors than in the combined service sector (excluding health, retail and accommodation and food services). The higher risk of illness in the transport sector is found to be due to the prevalence of demanding work arrangements such as shift work and long hours.
- The relationship between period and occupational illness varies somewhat across sectors. During the recession the likelihood of work-related illness was reduced in the service, agriculture, transport and health sectors. However, there was no significant difference between the boom and recession periods for those working in the retail/wholesale, accommodation or industry.

Job Characteristics

This study clearly identifies a number of working conditions and arrangements that have a negative impact on workers' health and risk of injury:

- Longer hours of work are associated with a higher probability of both injury and ill-health. However, when we make an adjustment for exposure, we find that those working a short number of hours (less than 20 hours per week) have the highest risk *per hour worked.*
- Highly variable working hours were also linked to higher injury and illness risks. This result is important in the light of the emergence of zero-hours and minimum hours contracts, and to the increasingly permeable boundaries between working time and leisure/family time due to technological change.
- Long hours and variable work hours are found more commonly among self-employed workers, but when these conditions as well as economic sector are taking into account, the self-employed do not differ from employees in their risk of non-fatal injury or illness.
- The self-employed were considerably over-represented in the fatal injury statistics. This is connected to their location in higher risk sectors such as agriculture and construction, but their risk of fatal injury may also be exacerbated by long working hours and the attendant problems of fatigue and concentration lapse.
- Those working shift patterns and those working at night were more likely to experience both injury and illness, controlling for a wide range of other job and sector characteristics.
- Job experience is also an important predictor of injury risk. Adjusting for exposure, we found that the rate of injury for those with a job tenure of one month or less was 16.8 per cent, compared to a rate of 2.4 per cent for those who had a tenure of over five years. Controlling for other factors, those with tenures of less than six months were four times more likely to have experienced a workplace injury that those with a tenure of over five years.

3. WORK-RELATED FATALITIES

Information on work-related fatalities comes from the database of the Health and Safety Authority.

- The fatality rate has been halved over the period 1998 to 2013, from 4 per 100,000 workers to 2 per 100,000 workers.
- Given the small number of deaths per year there is considerable fluctuation from year to year but the three-year rolling trend also shows a downward trajectory.
- Throughout the period the highest fatality rates occurred in the agriculture, forestry and fishing sector with very large variation ranging from 12.5 per 100,000 workers in 2009 to 30.5 per 100,000 workers in 2010.

- Using modelling techniques to explore the trend of fatalities across broad economic sectors we find that the fatality rates for industry, construction and the agriculture sectors are, respectively, two and a half, six and eleven times higher than in the service sector. Over the period 2004 to 2013, while the fatality rate has declined in the service sector, it increased significantly only in the agriculture sector.
- The latest figure available from Eurostat shows that Ireland in 2011 had the seventh largest fatality rate per 100,000 workers of the EU15.

4. IMPLICATIONS FOR POLICY

The study has identified a set of risks for work-related injury and illness. Greater risks are associated with specific groups of workers, working arrangements and economic sectors which may be useful in informing policies to reduce such risks. The study also identified a relationship between annual inspection rates and injury and illness rates:

- The study showed that annual inspection rates are positively associated with lower levels of injury and ill-health. The inspection regime appears to have a more positive effect on new recruits. However, with the cuts in public expenditure, the inspection rate has fallen since 2009 which might have negative consequences on workers' health and safety.
- Some workers with short job tenures have a distinctively greater risk of injury; investment in the training and monitoring of new workers is likely to contribute to the reduction in workplace injuries.
- Demanding work patterns, such as long hours, shift hours and variable working hours, have an adverse effect on work injuries and illnesses. It would, therefore, be important to inform employers, employees and self-employed about the costs and benefits of alternative working arrangements to prevent and reduce work-related injuries and illness.
- The study highlighted the high level of under-reporting of injuries to the Health and Safety Authority among the self-employed. The implementation of measures to extend the social insurance protection system to the self-employed in the case of work-related injuries and illness should improve the reporting of such events to the Health and Safety Authority. Such measures were examined by the Advisory Group on Tax and Social Welfare (2013).
- The steady rise of work-related illness rates since 2009 raises some concerns about the future trends of work-related illness and the long-term health consequences for workers. This recent trend highlights the need to monitor closely the health and safety status and well-being of workers as the level of employment is increasing.

Chapter 1

Introduction

1.1 LABOUR MARKET CHANGE AND THE HEALTH, SAFETY AND WELL-BEING OF WORKERS

The health and well-being of Irish workers is an important issue not just for workers and their employers but also for wider society and the economy. The European Commission recognises that promoting health, safety and the quality of work is important for economic growth and improving productivity.[3] The most extreme consequences involve cases where workers or members of the public are fatally injured. Work-related accidents continue to claim the lives of around 50 people per year in Ireland and these workers and their families pay the ultimate price for unsafe working conditions or practices.[4]

The precise scale of the costs for the different groups affected is difficult to establish (Weil, 2001). However, existing research suggests that costs of work-related ill-health and injuries for employees and their families are considerable and include pain, stress, medical costs and lost earnings (Pathak, 2008) and there is growing literature on negative spill-over from work into family life (Gallie and Russell, 2009). Costs for workers and their families can be both immediate and long-term. In fact, one of the difficulties in establishing the impact of workplace risks – especially those resulting in health problems rather than injury – and their costs is that there is sometimes a considerable time-lag between exposures and outcomes. For employers, the costs include productivity losses, compensation payments, sick pay, legal costs, increased insurance premia, replacement staff costs and more intangible costs such as loss of reputation and decreased staff morale and commitment (De Greef et al., 2011).

The International Labour Organisation (ILO) has estimated that the total costs of work-related accidents and ill-health amount to approximately 4 per cent of the world's GDP (ILO, 2006) while in Ireland the costs have been estimated to amount to 2.5 per cent of GDP (Department of Jobs, Enterprise and Innovation, cited in HSA 2013). In 2011 alone, it was estimated that over 590,000 working days were

[3] Communication from the Commission COM (2007) 62 Final. Improving quality at Work: Community Strategy on Health and Safety at Work 2007-2012.

[4] The average of 50 people from 2008 to 2013 includes workers and non-workers. It is about 43 people for workers only.

lost due to occupational accidents and a further 596,000 days were lost due to work-related illness (HSA, 2014). The costs for society and the economy not only include lost productivity but also compensation schemes for affected workers.[5]

Given the scale of these effects it is important to understand the factors that are associated with these outcomes and how risks have changed over time. This study considers changes in occupational illnesses, non-fatal injuries and fatal injuries between 2001 and 2012, which was a period of rapid change in the Irish labour market. The first half of this period was one of dramatic employment expansion. Employment grew by just under 400,000 between 2001 and 2007. The economic crash in 2008 led to a sharp reversal in employment trends. The numbers in employment shrank and unemployment increased rapidly.

Alongside these substantial business-cycle effects other longer term trends are evident in the Irish labour market. These include the shift away from manufacturing and agriculture to service sector employment, the rise in female employment, increased participation of migrant workers, and the growth in part-time and other non-standard contracts of employment. These changes are likely to have significant implications for occupational health, safety and well-being at work. The European Agency for Safety and Health at Work has identified the ageing workforce, new forms of employment contracts, high emotional demands at work, work intensification and poor work-life balance as key emerging psychosocial risks for the occupational health and safety of workers (EU-OSHA, 2007). Lack of physical activity and combined exposure to musculoskeletal disorders (MSDs) and psychosocial risk factors were identified among the top emerging physical risks (EU-OSHA, 2005).

Occupational Injury and Illness and the Business Cycle

The consequences of growth and recession for worker health and safety are not altogether clear. There is some international evidence that workplace accident rates are pro-cyclical, i.e. that the rate of accidents increases with economic growth (Fairris, 1998; Robinson and Shor, 1989; Davies and Jones, 2005). For example in the UK, Davies and Jones found that a 1 per cent increase in GDP was associated with a 1.4 per cent increase in major accidents. Studies have attributed the association to greater work effort during periods of increased demand including an increase in work hours and the use of overtime. Greater work intensity and work hours are thought to increase injury and illness risk through mechanisms such as stress and fatigue. It has also been argued that the

[5] For example, in 2011 expenditure on Occupational Injury Benefit amounted to €16.5 million and expenditure on Disablement Benefit was €77.5 million (Department of Social Protection, 2012).

higher recruitment rates that are associated with economic growth mean a greater proportion of inexperienced workers which increases accident risks (Davies and Jones, 2005). Boone et al. (2006, 2011) suggest that the pro-cyclical increase in accident rates is actually due to reporting behaviour. Using data for the Netherlands they find that during periods of high unemployment, workers are more reluctant to report accidents to managers or employers.

There are also a number of counter-cyclical influences which would lead to an expectation that recession rather than growth would be associated with higher levels of workplace injuries and illness. Nichols (1999) argues that recession reduces employees' power to resist intensification or unsafe work practices. Moreover recession may be linked to cuts in training and safety budgets. Indeed recent research suggests that the economic crisis in Europe has been associated with changes in a variety of indicators of job quality such as pressure, work-family conflict, insecurity and training in many European countries (Gallie 2013). In Ireland, a significant increase in job pressure was observed during the recession particularly for those in workplaces where there had been restructuring or where the numbers employed had declined (Russell and McGinnity, 2013). It is suggested that where job losses occur, 'survivors' may be left with greater workloads or new responsibilities that increase work pressure. Issues of job quality are equally important during an economic upturn in terms of the nature of the new jobs created.

Work-related ill-health[6] covers both physical and mental health problems that are caused or aggravated by work. The two largest categories are musculoskeletal disorders and stress, depression and anxiety (HSA, 2014). Diseases such as asbestosis and other cancers may also be work-related. However because there is often a considerable delay between exposure and disease onset and because disease causes are often multi-factorial, it may be difficult to establish the link between work and illness.[7] These longer-term occupational illnesses are not generally picked up in cross-sectional surveys of workers of the kind used in this study. The precise survey questions used to record work-related illness are outlined in Chapter 2.

A range of work characteristics and working conditions have been linked to ill-health, both physical and psychological. Higher work demand in the form of long hours, job pressure and overload has been frequently linked to psychological illness (Michie and Williams 2003; Stansfeld et al., 1999; Cherry et al., 2005;

[6] In the report we use the terms work-related ill-health and occupational illness interchangeably.

[7] Cancers are monitored by the National Cancer Registry and the HSA maintains records of exposure to asbestos and to cases of asbestosis.

Chandola, 2010). Lack of control over work has been associated with a higher risk of both mental (Michie and Williams, 2003) and physical ill-health (Marmot et al., 1997). Poor personal relations at work have also been implicated in work-related illness (Cherry, et al., 2005; Michie and Williams, 2003). There is also a wide body of research linking job insecurity to poor psychological health (Burchell et al., 2002; De Witte, 1999).

There is somewhat less evidence on the relationship between occupational illness and the business-cycle. Robinson and Shor (1989) found that while the rate of illness in manufacturing was pro-cyclical, in the construction sector illness decreased with employment growth.[8] Some of processes linking illness to the business cycle are likely to be the same as those that connect economic conditions and levels of work related injury. They may include the effects of increased work pressure/intensity and incentives and disincentives to reporting. Incentives to report might include changes to sickness or injury benefits, while disincentives would include job insecurity. Absenteeism tends to fall during a recession, as workers are less likely to take sick leave when they feel insecure in their employment (Shapiro and Stiglitz, 1984; Livanos and Zangelidis, 2013).

In the next section we will describe the nature and scale of the labour market changes in Ireland over the early 2000s including sectoral changes and shifts in the composition of the workforce. Section 1.3 will describe the policy context. Some broad evidence on trends in occupational injury and illness in Europe will be set out in Section 1.4. Finally in Section 1.5 the data sources and methodology used in this study will be described and the limitations outlined.

1.2 ECONOMIC AND LABOUR MARKET CONTEXT

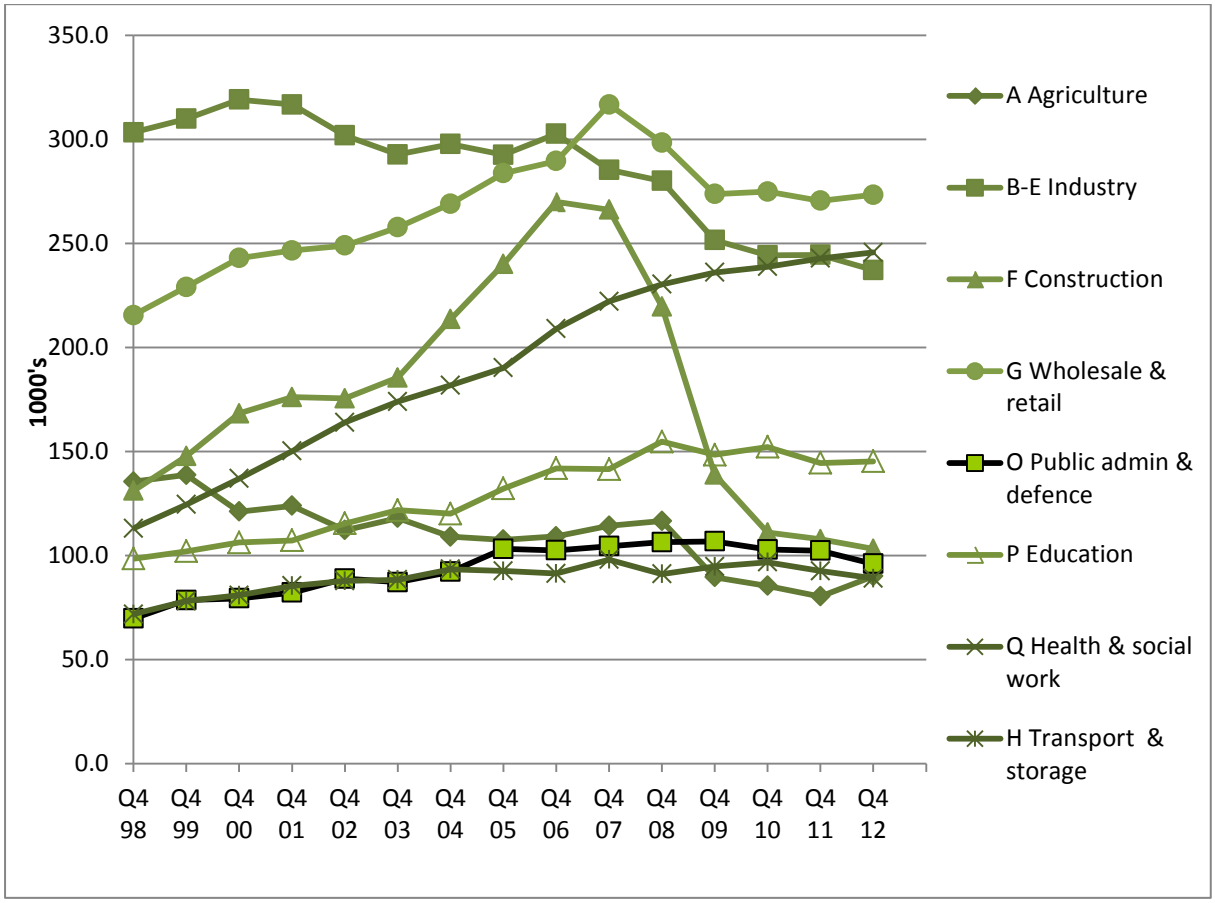
There have been substantial labour market changes over the period 2002 to 2013. These changes have played out most dramatically in the expansion and contraction of the construction sector (Figure 1.1). Employment in manufacturing was in decline during the early 2000s but this trend was accelerated by the recession. There has been a long-term decline in agricultural employment since the 1970s (Matthews, 2003). There was a brief reversal in this trend in the final stages of the boom 2006-2008, but agricultural employment fell sharply again in recession. Other sectors driven by domestic demand such as retail/Wholesale and accommodation/food, expanded and subsequently fell significantly, while the numbers employed in sectors such as health and information and communication continued to rise despite the onset of recession (Russell et al.,

[8] The authors emphasise that changes in definition and in illness compensation over the period studied (1950s to 1980s) mean that the illness patterns should be interpreted with caution.

2014). There were also changes in the relative size of the public and private sector. Given the strong patterning of occupational injuries and ill-health by sector (HSA statistical reports various years; Hassan et al., 2009) these structural changes are likely to influence the outcomes observed over time.

Recent figures from the CSO suggest that employment grew by 42,700 during 2013.[9] The sectoral distribution of this employment growth is uncertain. The figures show a significant rise in agricultural employment; however, the CSO has advised that these recent sectoral changes may be an artefact of sampling changes.

FIGURE 1.1 Trends in Employment (1000s) by Selected Sectors 1998-2013



Source: QNHS.

There have also been significant long-term shifts in occupations with a considerable decrease in manual employment, a trend which has continued in more recent years. However, due to changing occupational classifications, there

[9] 42,700 represents the increase in employment from Q1 2013 to Q1 2014 (CSO, Statistical Release May 2014).

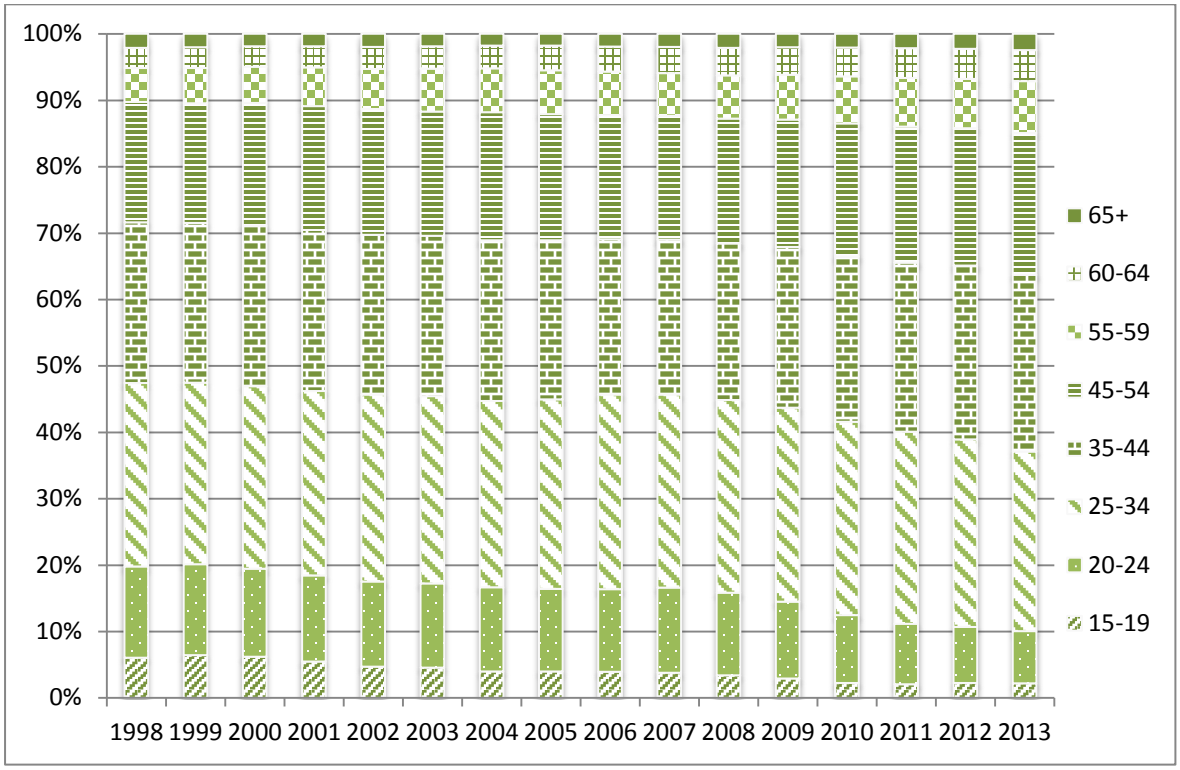
are no long-term data on detailed occupational categories. For example in 2007 20.5 per cent of workers were in skilled trade occupations but by 2013 this had fallen to 14.8 per cent; similarly the percentage in process or machine operatives fell from 8.0 to 7.6 per cent. Under the old classification, 11 per cent of workers were machine operatives in 1998. In contrast, the proportion of the workforce in managerial and professional occupations has increased significantly over time. These occupational changes expose workers to different levels and types of risks.

As noted above, changes in the sectoral distribution in employment have also been accompanied by changes in the composition of the workforce in terms of characteristics such as gender, nationality and age.

The ageing of the workforce can be seen in Figure 1.2. The proportion of those employed aged over 55 increased from 11 per cent in 1998 to 16 per cent in 2013. Moreover there is evidence of the strong fall in youth employment following the economic crash. Young people aged under 25 accounted for 16 per cent of the employed in 2007 but for only 8 per cent in 2013.

Work-related ill-health tends to rise with age until a point close to retirement age when the risk drops (Davies et al., 2013). This pattern is explained by the greater propensity of those in the oldest age group with poor health to leave the labour market earlier than the usual retirement age (the ‘healthy worker effect’).

FIGURE 1.2 Age Composition of the Employed Population in Ireland 1998-2013



Source: QNHS.

Both Irish and European data show that occupational injury and ill-health are differentiated by gender (HSA statistical reports; EU-OSHA 2013). This reflects the substantial gender segregation in employment both in terms of sector and occupational position and differences in the working arrangements of men and women (Russell et al., 2014). Controlling for occupation, industry and a range of other job and personal characteristics, Davies et al. (2013) found that men were 16 per cent less likely to suffer work-related ill-health than women.

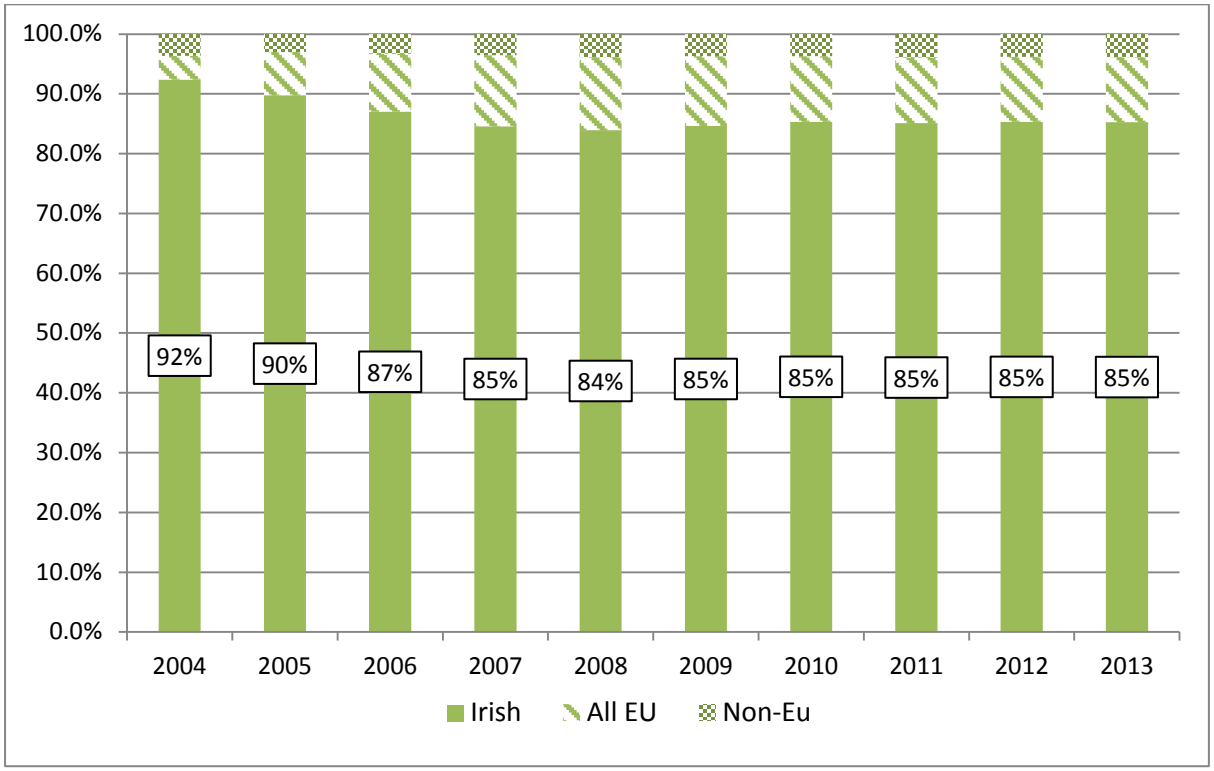
An analysis of work-related injuries in the UK found that injury rate for men was almost twice that for women. However, when factors such as hours, occupation, industry and tenure were taken into account men were approximately 9 per cent more likely than women to have an injury resulting in three or more days absence from work (Davies and Jones, 2005).

FIGURE 1.3 Gender Composition of the Employed Population 1998-2013

Source: QNHS.

The last decade has been one of considerable change in migration patterns. During the boom period Ireland went from being a country of net out-migration to one of net in-migration. Migration patterns were also greatly influenced by the expansion of the EU with the accession of ten new Member States in 2004 and a further two new Member States in 2007. Consequently, the proportions of non-Irish nationals in the Irish workforce increased to a peak of 16 per cent in 2008. Since 2009, the proportion of non-Irish nationals amongst the employed has remained stable at 15 per cent. Research in the UK and the US has considered ethnic group differences in occupational injury and illness; however it is unclear whether these findings are relevant to Ireland where the history of immigration is very recent and the largest migrant group are white Europeans, who on average have higher qualifications than the Irish working age population (McGinnity et al., 2013).

FIGURE 1.4 Composition of the Employed Population by Nationality 2004-2013

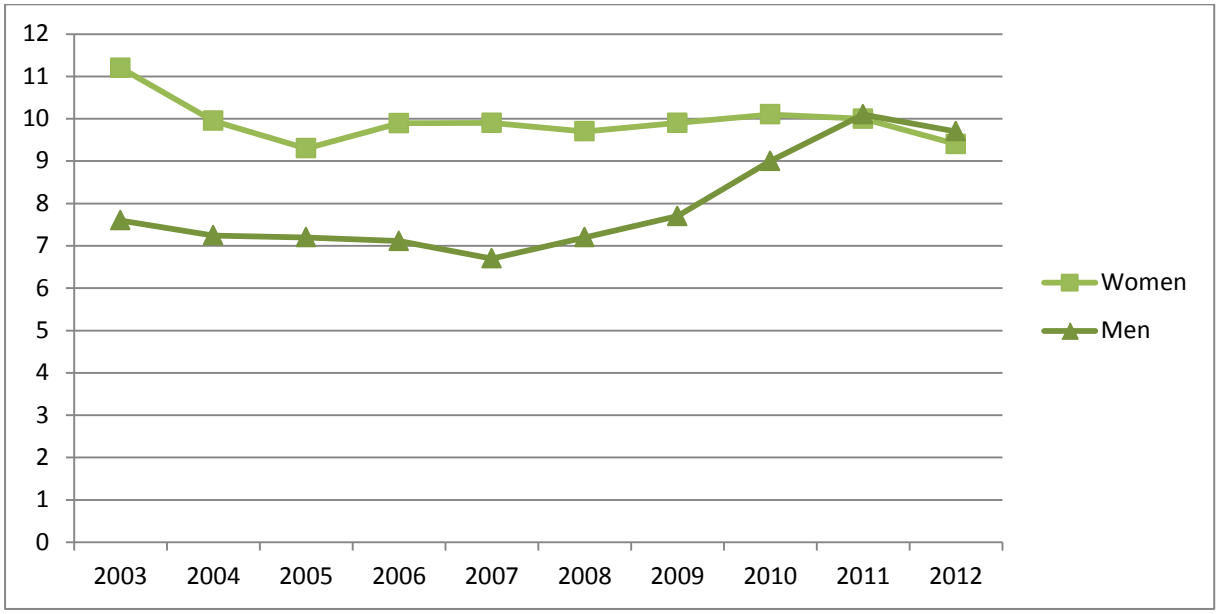


Source: QNHS.

Working Arrangements

Previous research has suggested that work practices such as temporary employment and hours worked are correlated with occupational health, safety and well-being (Ardito et al., 2012; Davies et al., 2013; Gash et al., 2007). Therefore the extent of these arrangements as well as recent changes in levels will be described. The use of temporary contracts in Ireland is low by European standards, which is usually attributed to the relatively weak distinction between temporary and permanent employment in terms of the protection against dismissal in Ireland and other liberal economies compared to those in Western and Southern Europe (see for example Gallie 2010). Over the 2000's there was little change in the rate of temporary employment which hovered between 8 and 10 per cent. However a breakdown by gender shows that the recession brought an increase in temporary employment among men. When subjective measures of insecurity are examined, such as workers' fear of losing their job in the next six months, there has been a much more significant upsurge over the recession period (Russell et al., 2014). Given that insecurity has been identified as a risk factor for work-related illness by the EU agency for health and safety this may have implications for illness trends.

FIGURE 1.5 Non-Permanent Employment in Ireland (Percentage of Employed)



Source: Russell et al. (2013) based on analysis of QNHS microdata.

A number of studies have identified long working hours, overtime and shift-work as risk factors for occupational injury and illness (Dembe et al., 2005). However, UK Davies and Jones (2005) found that adjusting for exposure, those with very short working hours in the UK (less than ten hours per week) had a significantly higher risk of injury than those working 40-45 hours and those working over 60 hours had no increased risk. They nevertheless find that at the macro level (across industries and years) an increase in the rate of working overtime, measured by the ratio of actual to usual hours, is associated with higher rates of workplace injury (*ibid*, p60).

In Ireland there has been a long-term decline in average weekly working hours from 43.4 hours in 1990, to 38.1 hours in 2000 to 35.0 hours in 2012. These averages disguise significant differences between men and women, with men working significantly longer hours than women, but for both sexes the downward trend in hours is visible since the early 1990s (O'Connell and Russell, 2007; Layte et al., 2008). In the UK the decline in average working hours masked a polarisation in hours with a greater number of people working very short and very long hours. However in Ireland, the period 2003 to 2012 shows a more general downward shift in working time and there has been a decline in the numbers working over 50 hours (see Table 1.1). If the association between hours and ill-health and accidents is positive then this trend should lead to an improvement in occupational health and safety, all else being equal. However,

research has also revealed some adverse changes in working time across Europe (including Ireland) such as an increase in the proportion of workers who have to work overtime at short notice between 2004 and 2010 (McGinnity and Russell, 2013).

TABLE 1.1 Distribution of Hours of Work by Gender 2003-2012, All Employed

	Male			Female		
	2003	2007	2012	2003	2007	2012
Under 15	1.9	1.7	2.7	7.4	7.9	7.5
15-29 hours	5.2	5.9	10.5	26.4	28.0	29.7
30-39 hours	42.8	43.7	38.0	48.1	46.2	42.9
40-49 hours	32.9	35.1	35.9	15.4	15.6	17.7
over 50 hours	17.2	13.6	12.9	2.6	2.3	2.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Russell et al., 2014 based on analysis of QNHS microdata, Q4 for each year.
All employed (employees plus self-employed) aged 15+.

1.3 POLICY CONTEXT

In Ireland the statutory body with responsibility for the monitoring, prevention and inspection of occupational health and safety is the Health and Safety Authority (HSA). The activities of the HSA include promotion of employee safety, health and welfare through activities such as information campaigns, guidance material, supporting the inclusion of occupational health and safety into education syllibi, presentations to key groups, publishing safety alerts together with enforcement actions such as inspections, issuing enforcement notices and prosecutions (HSA Annual Reports, various years).

Employers are legally required to report incidents to the Authority when injuries result in four or more days' absence from work. Incidents related to a place of work or a work activity in which a member of the public is injured is also reportable to the HSA, where the person requires treatment from a medical practitioner.[10] These data are used to monitor work-related injuries over time and are one of the sources used in the study (see section 1.4 below). The HSA also investigates all work-related fatalities. In the case of a fatal accident involving an employee at work, the employer is responsible for reporting the accident. If the person fatally injured is a self-employed person the owner or tenant in the

[10] For further information see www.hsa.ie/eng/Topics/Accident_and_Dangerous_Occurrence_Reporting/#reportableaccidents.

place of work is responsible for reporting the accident. The accident should be reported to the HSA as well as to the Gardaí.

In Table 1.2 we outline changes in the inspection regime because this may have an impact on the detection of health and safety violations, on the one hand, and on the incentive for firms to invest in health and safety measures, on the other. Over the period examined in this study the rate of inspections per 1,000 workers has fluctuated between 6.1 and 9.4. Both the rate and the number of inspections peaked in 2009 and since then both have declined and the inspection rate in 2013 was 6.5 per 1,000 workers. This fall has taken place in the context of staffing and budget cuts to the inspectorate. The grant from central government to the inspectorate fell from a high of €24.2 million in 2008 to €18.8 million in 2013. On a per capita basis (ratio of the government grant to the numbers at work), levels of government funding in 2013 were back below those observed in 2006.

TABLE 1.2 Characteristics of the Irish Health and Safety Inspectorate 2001-2013

Year	Inspections	N at work	Rate per 1,000 at work	N of inspectors	Average inspection per inspector	Grant €	Per capita Grant €
2001	13,940	1,749,625	8.0	90	154.9	N/A	N/A
2002	12,896	1,776,525	7.3	87	148.2	N/A	N/A
2003	10,704	1,810,075	5.9	100	107.0	13,453,000	7.4
2004	11,382	1,871,100	6.1	100	113.8	14,384,000	7.7
2005	13,552	1,962,775	6.9	100	135.5	18,149,000	9.2
2006	15,365	2,053,550	7.5	115	133.6	20,998,000	10.2
2007	13,631	2,143,075	6.4	120[1]	113.4	22,962,167	10.7
2008	16,009	2,128,400	7.5	128	133.2	24,235,450	11.4
2009	18,451	1,961,350	9.4	123	157.3	22,561,000	11.5
2010	16,714	1,882,225	8.9	121	148.0	19,984,000	10.6
2011	15,340	1,849,100	8.3	115	141.9	19,968,000	10.8
2012	13,835	1,837,825	7.5	112	133.4	19,146,000	10.4
2013	12,244	1,881,150	6.5	107	123.6	18,780,000	10.0

Source: Figures on inspections, staffing and government grant are taken from HSA Annual reports. The number of inspectors for the years 2008 to 2013 were provided directly to the authors by the HSA, the figure for 2007 is an estimate.

Note: N at work based on the QNHS figures.
N/A Not Available.

It is also instructive to consider the Irish inspection regime in comparative context. Figures from the EU labour body suggest that the size of the health and safety inspectorate is small by EU standards (Table 1.3). The number of workers

per inspector suggests that Irish inspectors have a comparatively high load, which may have implications for effectiveness and compliance.

TABLE 1.3 Inspectors Relative to Employee Numbers, EU (Average 2010, 2011)

	Total Number of Employees	Number of Inspectors	Number of Employees per Inspector
LU	204,200	43	4,749
IT	17,166,000	3,300	5,202
LT	1,098,900	196	5,607
UK	24,378,100	4,061	6,003
SK	1,937,100	299	6,479
FI	2,124,100	319	6,659
LV	747,100	111	6,731
DK	2,416,700	350	6,905
PL	11,911,200	1,621	7,348
BG	2,581,300	337	7,660
ES	15,325,000	1,865	8,217
SI	775,800	88	8,816
PT	3,681,500	404	9,113
EL	2,574,900	279	9,229
RO	6,146,500	660	9,313
FR	22,651,600	2,256	10,041
MT	143,000	13	11,000
DE	34,712,900	3,029	11,460
CZ	3,947,000	336	11,747
AT	3,552,300	297	11,961
EE	532,000	43	12,372
IE	**1,528,400**	**122**	**12,528**
HU	3,333,800	250	13,335
CY	324,400	24	13,517
SE	4,073,100	255	15,973
BE	3,852,300	189	20,383
NL	7,052,400	238	29,632

Source: Figures for the number of employees in 2011 come from the European Labour Force Survey 2011. The number of inspectors come from the Senior Inspectorate in Europe (personal communication). The figures are supplied to the Inspectorate by national agencies and may not be fully harmonised. We are advised that the number of inspectors in most cases relates to 2011 but in some cases may refer to an earlier year.

Other health and safety interventions take place at the organisational or firm level such as safety audits and training. Information on safety statement compliance collected by the HSA has been used as a proxy measure for monitoring trends in organisational implementation of health and safety

regulation. There has been a steady increase in the proportion of workplaces with a safety statement, from 38 per cent in 1994 to 51 percent in 2000 to 72 per cent in 2013 (HSA, 2014; HSA 2005). However these figures are only collected in relation to inspected workplaces and therefore are not representative of workplaces across the economy.[11]

Prevention of occupational illness and injury also involves education and health and safety promotion campaigns. These may, for example, be targeted at young people through the education system, at the general public through media campaigns, or at specific high risk groups of workers through publications, public meetings and other forms of communication. Actions taken in Ireland during 2013 included delivery of an educational programme *Choose Safety* to 17,536 Transition Year and senior cycle students in Irish schools, production of a new DVD, *Older, Wiser, Safer*, developed with the Irish Farmers Association, to focus on safety issues for older farmers, and publication of new guidance entitled '*An Introduction to the Management of Manual Handling in the construction sector*' (see HSA, 2014b for a full list of actions).

At the European level there is a very substantial body of legislation that regulates health and safety at work, the most important of which is the European Framework Directive on Safety and Health at Work (1989).[12] The provisions have been enhanced over the years to regulate specific sectors and risks, and there has been a growing recognition of the psychological health of workers, including issues of work pressure and work-related stress. EU policies to address the ageing society, and to create employment that is sustainable over a longer working life, are also dependent upon creating a healthy and safe working environment for older workers.

During the period addressed by the current study, the European Commission issued two Community strategies on health and safety at work.[13] The first strategy covered the period 2002-2006 and the second covered the period 2007-2012. The primary objective of both strategies was to bring about a reduction in accidents at work and occupational illnesses. The 2007-2012 strategy set a target to reduce the rate of accidents at work per 100,000 workers by 25 per cent across the EU27.

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11 While a certain proportion of workplaces are inspected at random, there is a higher Inspection rate for higher risk sectors. Inspections also take place in response to incidents and complaints.

12 This consists of five individual directives.

13 European Commission (2002) 'Adapting to Change in Work and Society: a New Community Strategy on Health and Safety at Work 2002-2006', and European Commission (2007) 'Improving Quality at Work: Community Strategy 2007-2012 on Health and Safety at Work'.

Differences in reporting systems make it difficult to compare occupational injury and illness across countries (see below). Nevertheless, the collection of harmonised data through the European Labour Force Survey (EU LFS) special module in 1999 and 2007 allowed the comparison of trends in accidents at work across ten countries, and illnesses across nine countries (Eurostat 2010).[14] These figures show that there was a decrease in the percentage of workers experiencing accidents from 3.5 per cent in 1999 to 3.3 per cent in 2007. This decrease was entirely due to a decline in the percentage for men (from 4.4 per cent to 4.1 per cent) while the figure for women remained stable in both years (2.4 per cent).

The 2007 EU LFS showed that 8.6 per cent of respondents across the EU27 had a work-related health problem, which corresponded to approximately 23 million persons (Eurostat, 2010, p 41). Among the subset of countries for which trends could be observed, the occurrence of work-related health problems increased from 4.7 per cent in 1999 to 7.1 per cent in 2007. The increase was very similar for men and women. Increases were observed in both psychological health problems (stress, depression or anxiety) and physical health problems (musculoskeletal problems) which were the two largest categories of illness. These international trends suggest that the target 25 per cent reduction set out in the 2007-2012 community strategy is ambitious.

1.4 STRUCTURE OF THE REPORT

The report takes the following structure. In Chapter 2 the main trends in the occupational injury and illness rates are presented drawing on the CSO QNHS data. In Chapter 3 the factors influencing the likelihood of work-related injury and illness are statistically modelled; this allows us to separate out the individual influence of different factors such as characteristics of the worker and of the job (contract type, hours, sector). The modelling strategy also allows us to examine changes over time in the level of work-related injury and illness and to test whether the trends observed can be explained by the considerable changes in the structure of employment and the characteristics of workers as described above. In Chapter 4 we turn to the HSA data to analyse how the causes and context of work-related injuries and the worker fatalities have changed over the period 2001 to 2013. In the final chapter we draw out the implications for policy and emerging issues for occupational injuries and illness.

[14] Ireland was included in the accident statistics but not in the illness figures due to wording differences in the questionnaire.

Chapter 2

Measuring Work-Related Injury and Illness: Data and Methods

2.1 DATA SOURCES

No one source provides a comprehensive picture of occupational injury and illness; therefore a variety of sources are used in this study. These data sources are described below and the strengths and limitations of each are outlined. Groups who are particularly likely to under-report are identified in order to aid the interpretation of the analyses that follow.

Quarterly National Household Survey (QNHS) Module on Work-Related Accidents and Illness

The main sources of data for the current study are the annual special modules on work-related accidents and illnesses collected as part of the QNHS. The Central Statistics Office (CSO) has provided micro-data for the modules carried out in the years 2002 to 2013, which provide data for accidents in the years 2001 to 2012.

The module is restricted to those who are employed at the time of the survey or who were not currently employed but worked during the 12-month reference period. The module is usually fielded in Quarter 1 and from 2009 it refers to incidents occurring in the 12 months of the preceding calendar year.[15] So for example the module fielded in Q1 2012 asked:

> *"How many, if any, injuries did you incur at work (excluding commuting) during the period January 2011 to December 2011?"*

The most recent data comes from the 2013 module which was held in Quarter 2 2013. The module was part of the European-wide labour force survey and a number of changes were introduced so that the data are harmonised across the EU.[16] The first change was the shift in field date from Quarter 1 to Quarter 2. Secondly, the reference period was changed from the previous calendar year to the 12 months preceding the interview date. Thirdly, changes were made to the question wording.

[15] Pre-2009 the module referred to the 12 months prior to the interview (CSO personal communication).

[16] The 2007 module was also carried out across the EU and therefore similar issues arise for that year (Venema et al., 2009).

The information on work-related injuries was collected in two steps. Respondents were initially asked:

> *In the twelve months previous to this interview have you experienced any accidents at work or in the course of your work?*

(NOTE: Accidents outside working hours and accidents during the journey from home to work or from work to home are excluded. However, accidents during a journey in the course of work are included).

This is followed by a question on the number of accidents which also introduces the qualification that the incident resulted in an injury:

> *How many accidents resulting in injury did you have during those months?*

For the analysis that follows, the injury figures include only those who had an accident resulting in an injury i.e. those who answered 'yes' to both questions. This is the category that is most consistent with the previous modules which ask about injuries incurred at work.

Eurostat also specified a different set of response categories for the question on duration of absence from work. Previous modules allowed respondents to specify the exact number of days but the 2013 module provides closed categories.[17] In both cases the duration refers to the reference year so a maximum of 365 days (or more precisely 231 working days) is allowed. One consequence of this change is that the total number of days lost to the economy cannot be calculated in the 2013 data. Furthermore the categories for 2012 create ambiguity around the 'zero to three day' and 'four plus days' cut off. It is not clear where those who answer 'still off work intending to return' should be placed. Checks using information from the earlier survey suggested that these respondents should be grouped with those reporting four or more day's absence but the question wording introduces some inaccuracy.

[17] The duration of absence categories in the 2013 module (for the year 2012) are:
Still off work but expects to resume work;
Expects never to work again;
Less than one day or no time off;
At least one day but less than four days;
At least four days but less than two weeks;
At least two weeks but less than one month;
At least one month but less than three months;
At least three months but less than six months;
At least six months but less than nine months;
Between nine and twelve months.

This set of changes should be kept in mind when interpreting trends over time in the injury rates based on the QNHS data.

Work-Related Illness

The QNHS module is also the source of information for the work-related illness statistics presented below. As with the question on injury, the questions were asked to those who are currently employed or were employed during the last 12 months. Between 2009 and 2012, respondents were asked

> *How many, **if any**, illnesses or disabilities have you experienced during the 12 months January 20XX to December 20XX, that you believe were caused or made worse by your work?*
>
> *Now thinking about the time(s) when you were in employment during the 12 month period January 20XX to December 20XX, how many days were you absent from your job as a result of your **most recent** work-related illness?*

In the modules from 2009 to 2012, respondents were asked about the previous calendar year. Before 2009 the question referred to the 12 months prior to the interview. In the 2013 European-wide module, information on work-related ill-health was collected using the following questions as specified by Eurostat:

> *In the 12 months prior to this interview and excluding any accidents you might have highlighted already, have you suffered from any physical or mental health problems?*
>
> *How many of these health problems are caused or made worse by work you are doing or have done in the past?*

The addition of the phrase 'have done in the past' may mean that respondents are more likely to mention long-standing health problems caused by previous employment.

The data in the QNHS are re-weighted to reflect the national distribution of the population, and are grossed up to reflect the actual numbers in employment.

While the QNHS provides the best randomised national sample of work-related injuries and illnesses there are nevertheless a number of limitations. One important limitation of the data and study is the 'healthy worker effect'. This reflects a selection process through which the most unhealthy/seriously injured leave the labour market and the more healthy workers remain. Those who have

not worked in the last 12 months are not included in the QNHS module and therefore the extent of work-related illnesses and injuries are underestimated. All else being equal, the propensity of 'unhealthy' workers to leave the labour market will depend upon both the extent to which employers accommodate those with disabilities or illness and the level of compensation available through the welfare system. The number of claimants receiving benefits due to occupational injury or disability followed the numbers employed: rising between 2000 and 2007 and falling from 2008. The number of claims per 1,000 employed, however, remained relatively stable over the 2000s (see Appendix Table A1.3). Moreover the proportion of those of working age who say they are unable to work due to illness or disability stayed at between 3 and 4 per cent since 2004 (see Appendix Table A1.4).

A further limitation of the illness statistics arises from the fact that there may be a significant time lapse between exposure to a workplace hazard and the emergence of an illness. Such an issue arises for many cancers and for musculoskeletal problems (Drummond, 2007b). The tendency of workers with a chronic illness or a disability to change to a less demanding job may also influence the association between work-related illness and occupation, sector or hours of work found in the data.

A final caveat concerning the QNHS module data is that although the number of respondents is large, occupational injury and illness events are uncommon and therefore the un-weighted numbers are relatively small. This is especially true when the figures are broken down by sector or some other characteristic. The statistical models take the underlying numbers into account when establishing significance but frequency tables for sub-groups should be treated with caution.

Health and Safety Authority (HSA) Data

The second source of data used in the study is the HSA database of reported injuries and fatalities. Only injuries to workers that involve an absence of four or more days from work are reportable to the HSA and therefore represent a subset of accidents where the injury is serious enough to warrant an absence from work of four or more days. The analysis here is restricted to workers so that injuries to members of the public reported to the HSA are excluded. The HSA database provides information on the characteristics of the accident victim, the nature of the incident, the working environment and the proximate cause or 'trigger' – information that is not available in any other data source. The categories of injury recorded, work environment, injury triggers and the definitions to be used for

other classification variables such as sector and occupation are set out by the European Statistics on Accidents at Work (ESAW).[18]

It is known that there is significant under-reporting of accidents to the HSA as is the case in other national employer reporting systems. In 2012, 6,590 worker injuries were recorded, while the CSO figures for the same period suggest that there were 17,786 work-related accidents that resulted in an absence of four or more days (see Table 2.1).[19] These results suggest that approximately 37 per cent of the injuries were captured in the HSA database in 2012. This is similar to the level of under-reporting estimated by the Health and Safety Executive in the UK, which operates a similar reporting regime.[20] The incentives and disincentives to reporting non-fatal incidents can vary significantly across different groups. Comparison with figures from the CSO suggests that under-reporting of accidents to the HSA is particularly evident among the self-employed and smaller employers. For example, less than 1 per cent of work-related accidents reported to the HSA in 2012 came from the self-employed compared to 21 per cent of the injuries causing four or more days absence identified in the QNHS module (see Appendix Table A1.1). Rates of injury reporting also differ substantially between economic sectors (Appendix Table A1.2); reporting rates are relatively high in the public administration/defence sector and the health sector, while under-reporting is particularly acute in agriculture/fishing/forestry, the accommodation/food sector and in construction.

TABLE 2.1 Estimate of Reporting Rates: Comparison of Injuries Involving Four or More Days Absence, QNHS Module and HSA

	2004	2005	2006	2007	2008	2009	2010	2011	2012
QNHS	22,032	23,840	24,392	28,792	17,898	11,454	19,475	16,843	17,786
Reported to HSA	7,760	7,794	7,761	8,153	7,908	6,779	7,331	6865	6,590
% reported to HSA	35%	33%	32%	28%	44%	59%	38%	41%	37%

Source: QNHS Module and HSA.
Note: Figures for 2013 are available in the HSA data set but not in the QNHS. HSA figures exclude accidents among non-workers.

The HSA data also contains information on work-related fatalities or fatalities in the workplace during the relevant calendar year. A review of research in other jurisdictions and a pilot study in Ireland comparing coroner files and HSA reports

18 Eurostat (2001) European statistics on accidents at work (ESAW) Methodology, 2001 Edition.
19 If accidents among those not employed at the time of the survey but employed in the previous 12-month period are included in the CSO figures, a total of 18,096 (4+ days) injuries are estimated.
20 It is estimated that for the period 2011-2012 only 44 per cent of relevant worker accidents were reported to the HSE (www.hse.gov.uk/statistics/tables/index.htm#riddor).

for one county suggest that work-related road traffic fatalities are under-recorded in the HSA register (Drummond, 2007b). Recent information on road traffic fatalities is available from the Road Safety Authority www.rsa.ie/en/RSA/Road-Safety/Our-Research/.

The fatality statistics presented also exclude deaths resulting from long-term work-related illness such as cancer. There are a number of alternative sources of information on deaths from occupational diseases in Ireland such as the National Cancer Registry and the register of deaths, however the diseases processes are often complex, multi-causal and can have a long latency period making it difficult to attribute death to occupational hazards (Drummond, 2007b).

Despite these limitations the injuries reported to the HSA provide a consistent record of a subset of work-related injuries and deaths that has been collected in a similar manner over a period of years. The underlying definition of reportable accidents/injuries to the HSA is set down in legislation and has not changed in practice since 1993.[21]

Occupational Injury Benefit Statistics

Figures on the number of claims for occupational injury benefits are provided by the Department of Social Protection. These represent claims made by insured persons who are injured during the course of their work.[22] In order to qualify, the period of absence must last at least four days.

A limitation of these data is that not all workers are covered by social insurance and not all injuries result in a claim. On 6 January 2014 the rules of the scheme changed so that payment is made from the seventh day of incapacity of work, rather than the fourth day of incapacity. This change does not affect the figures presented below because they relate to the year 2013. The figures on 'days lost' refer to the paid claim days, and therefore exclude the first three days of the claim and Sundays.

Eurostat Statistics

Eurostat, the statistical agency of the European Union sets out methodologies for Member States to collect information and produce statistics on occupational

[21] The Safety Health and Welfare at Work (General Application) Regulations, 1993.
[22] Unlike the QNHS module data, the benefit data include injuries incurred during the journey to and from work.

injuries and diseases. It compiles statistics based on injury data supplied by Member States.

European statistics on accidents at work (ESAW) is the main data source from Eurostat and provides data on accidents based on administrative data from the Member States. The data come from national registers, public insurance/social security schemes or national bodies responsible for the collection of data on accidents at work. The data include non-fatal accidents at work causing more than three days of absence as well as fatal accidents.

These data are reported in Chapter 3 below. There is a time-lag for the construction of the comparative statistics so that the most recent European-wide data refer to 2011. The Irish data come from the reports to the HSA. However the number of accidents (and the rates) cited by Eurostat differ from the HSA figures. The difference arises because, in countries without an insurance-based system (including Ireland), Eurostat adjusts the figures using estimates of under-reporting by branch of economic activity. Eurostat also calculates the harmonised rates for a subset of sectors, excluding public administration, health and education, and mining/quarrying, because these workers are not covered in many Member States.[23] For example, the Eurostat figure for Ireland is 11,101 for accidents resulting in more than three days absence, while the HSA figure is 7,094 or 6,865 excluding non-workers as ESAW does not include members of the public or family members (Eurostat 2001).

2.2 CALCULATING ACCIDENT, ILLNESS AND FATALITY RATES

In order to take account of changes in the level of employment both economy-wide and within different demographic groups and sectors, the rates of injury and illness are calculated per 1,000 workers. Fatality rates are calculated per 100,000 workers.

The question then arises as to what employment figure should be used for the denominator. This is particularly important around the years following 2008 during which there was a very sharp drop in employment in certain sectors, particularly construction and retail. In the statistics that follow, the rates have been calculated using the average level of employment across the four quarters of the relevant year. As the recorded accidents and illnesses occur over a 12-month period, and because employment levels fluctuate seasonally, the four-

[23] The harmonised statistics produced by Eurostat are available at http://epp.euorstat.ec.europa.eu/portal/page/portal/health/health_safety_work.

quarter average provides a better basis for calculating the incidence rate than any one particular quarter. This calculation is used for reported accidents and illnesses from both the QNHS and HSA. As the latest QNHS data on illness and injury was collected in Q2 2013 and refers to illness/injury in the 12 months prior to interview the employment levels were calculated across the four quarters from Q3 2012 to Q2 2013.

Since the fatality numbers were reported on a calendar year basis, the denominator for calculating the fatal injury rates is the number employed in the calendar year for all years. This is calculated by taking the average number employed across the four quarters of the calendar year, as reported in the QNHS statistics.

Chapter 3

Trends in Occupational Injury and Illness

In this chapter the broad trends in occupational injury and ill-health over a ten-year period are drawn out. While the trends take into account the very significant shifts in employment levels over the last decade, by calculating rates per 1,000 workers, they do not take account of the other changes outlined in Chapter 1, such as changes in the composition of the labour force. The models outlined in Chapter 3 allow us to examine trends while controlling for other compositional changes and any shifts in working conditions. This chapter focuses on information from the CSO Quarterly National Household Survey special modules on occupational injury and illness which are carried out once a year. Trends in the reports of injuries to the HSA are outlined in Appendix 2.

3.1 TRENDS IN OCCUPATIONAL INJURIES

The number of workers experiencing injuries at work increased during the economic boom, to peak at just over 64,000 in 2007, and subsequently fell in the recessionary period (Table 3.1). These figures reflect the steep rise and fall in the numbers in employment. Not all incidents are equally serious and Table 3.2 provides detail on the number and rate of work-related injuries by the duration of absence caused by the injury estimated for the most recent five years. Separate figures are presented for injuries causing more than three days absence from work that would be reportable to the HSA by employers and for injuries that resulted in less than four days absence. The total numbers experiencing an injury at work fell by 5,000 between 2011 and 2012. Expressed as a rate of those employed, there is a decline from 21.7 to 18.9 per 1,000 workers. There is a somewhat different pattern for injuries leading to less than four days absence and for more serious injuries: while the rate for the former fell from 12.6 to 9.3 per 1,000 workers, the rate for the latter increased marginally. It is likely that some of this difference arises from the change in question wording in the 2013 module.[24] In 2009 there was a particularly sharp drop in reportable accidents (4+ days) and consequently a significant fall in the number of days lost due to injury for that year. This drop coincided with a period of rapid labour market contraction and may reflect a greater risk of job loss among those with

[24] As noted in Chapter 1 the 2012 data on time absent included a category 'ongoing absence' these were included with absences of over three days. Our analysis of previous years suggests the around 70 per cent of this group would have absences of four or more days, therefore approximately 30 per cent of cases in 2012 could be misclassified on the length of absence variable.

occupational injuries, however we cannot rule out the possibility of response biases or other error for one particular year. In the following chapter we analyse how far year effects may be accounted for by changes in the industrial composition of the workforce and shifts in worker characteristics.

TABLE 3.1 Trends in Numbers Experiencing Any Work-Related Injury and Illness, 2001-2012

	Injuries (0+ days)	Illness (0+ days)
2001	46,500	33,603
2002	43,457	38,490
2003	45,730	40,523
2004	57,528	59,836
2005	57,765	64,430
2006	58,615	71,675
2007	64,206	59,273
2008	41,994	40,874
2009	32,010	30,593
2010	40,584	38,703
2011	40,097	48,436
2012	35,001	51,210
Total	563,878	578,173

Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.

TABLE 3.2 Number and Rate of People Suffering Injury, by Days Absent 2008–2012

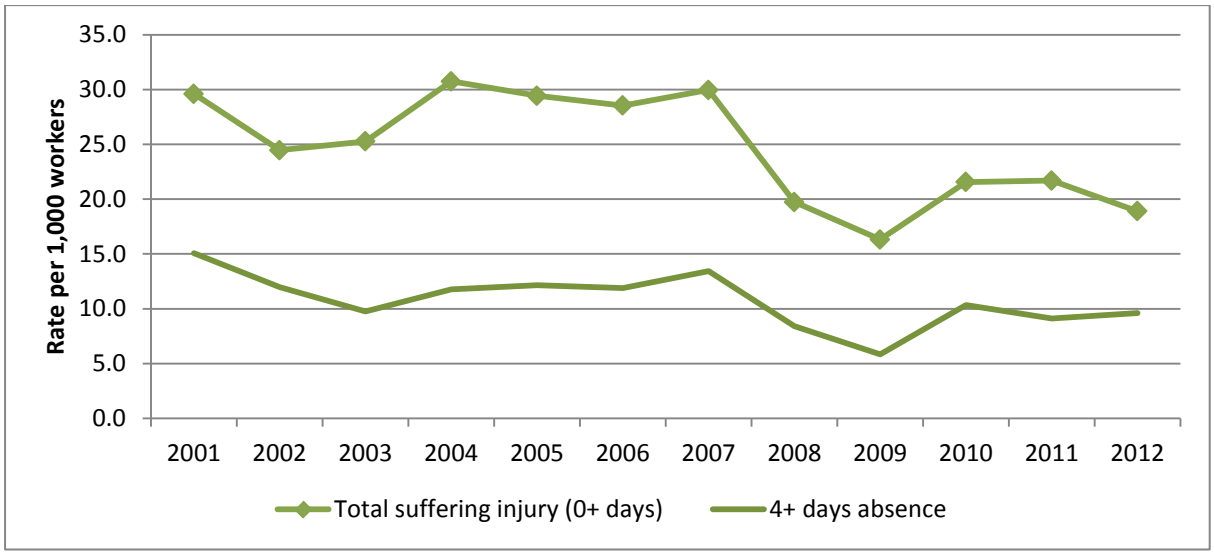
	2008		2009		2010		2011		2012	
	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000
Total in employment	2,128.325		1,961.275		1,882.175		1,850.050		1,851.425	
Total suffering injury	41,994	19.7	32,010	16.3	40,584	21.6	40,097	21.7	35,001	18.9
0-3 days' absence	24,096	11.3	20,556	10.5	21,109	11.2	23,254	12.6	17,214	9.3
4+days' absence	17,898	8.4	11,454	5.8	19,475	10.3	16,843	9.1	17,786	9.6
Days lost due to injury	685,500		283,200		666,553		590,690		N/A	

Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis..
Note: The employment figures relate to the average across the four relevant quarters. N/A: not available.

Figure 3.1 presents the injury rate (per 1,000 workers) from 2002 to 2012 covering both a period of economic expansion and recession. The total injury rate (0+ days) was highest during the period 2004 to 2007 at about 30.0 per 1,000 workers. As Ireland entered economic recession, the rate then fell steeply to reach a low of 16 per 1,000 workers in 2009, almost half of the 2004 rate. In the later period the injury rate increased slowly and stabilised at a rate of 19-22 injuries per 1,000 workers.

The trend for injuries causing four or more days absence follows a similar pattern. The injury rate is stable between 2002 and 2007 at about 10-13 per 1,000 workers before falling to 5.8 in 2009. From 2010 onwards the injury rates then increased to values around 10; levels that are only slightly lower than pre-recession.

FIGURE 3.1 Rate of Occupational Injury per 1,000 Workers, 2002-2012 (CSO)

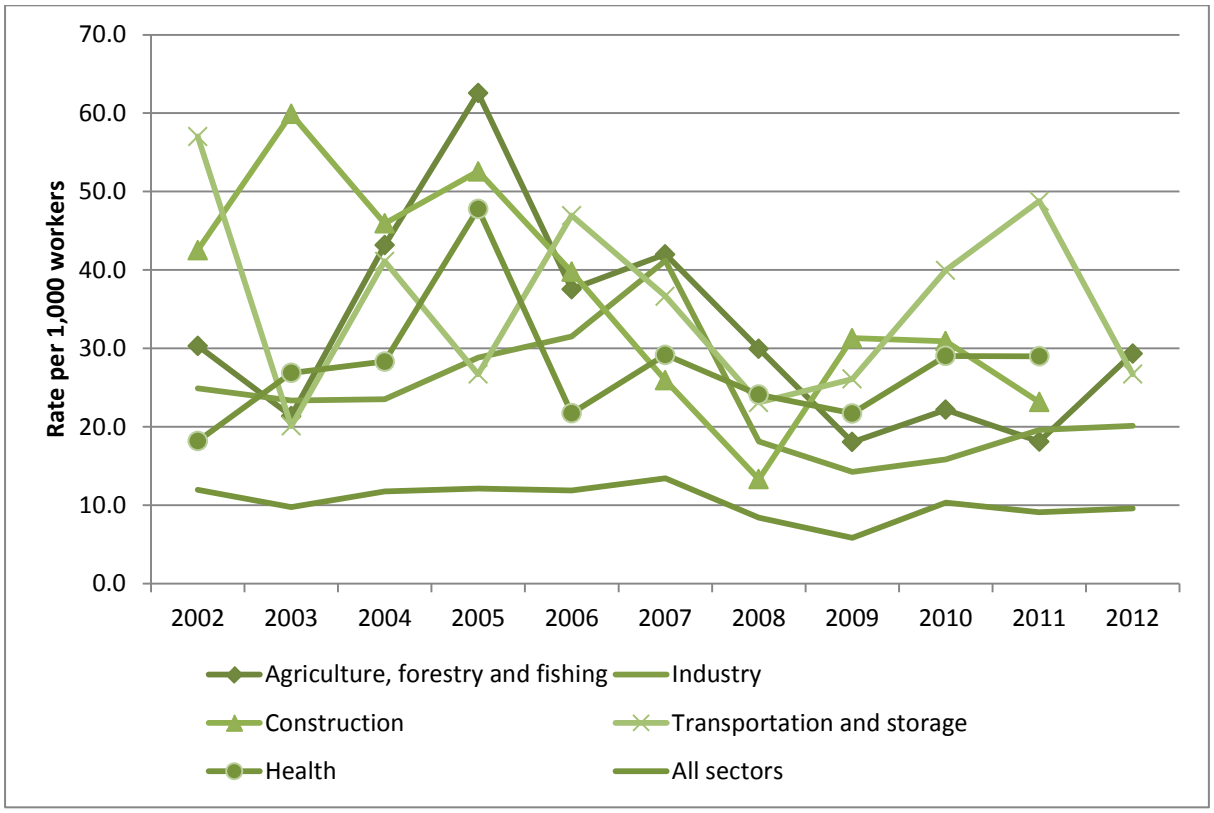


Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.

We report in Figure 3.2 the injury rates of 4+ days per 1,000 workers for a selected number of economic sectors that have historically had high injury rates. Looking first at the overall pattern we note that in the earlier years there is quite a large dispersion of injury rates between the sectors as illustrated for example for the construction sector (43 per 1,000) and the human health and social work activities (18 per 1,000) in 2003. All sectors experienced a downward trend in injury rates between 2002 and 2009 with some dramatic falls in some sectors such as in the construction sector. However, in the industry sector the injury rate increased between 2002 (25 per 1,000) and 2007 (41 per 1,000) before also falling in 2008 (18 per 1,000). Since the recession the gap between economic sectors has narrowed. In 2012 the highest injury rate of 29 per 1,000 was

recorded for agriculture, forestry and fishing followed by a rate of 20 per 1,000 for industry.

FIGURE 3.2 Rate of 4+ days Injuries per 1,000 Workers in Selected Sectors 2002-2012 (CSO)



Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.

Throughout the period considered, female workers had lower injury rates than male workers (Figure 3.3). For all injuries (0+ days absence), during the period of economic growth, the male injury rate increased from 29 per 1,000 in 2002 to 38 in 2007. From 2007 onwards the injury rate plunged to a low of 20 per 1,000 in 2009, before increasing again in the recent period with more moderate values in the mid-twenties. The pattern of female injury rate is different during the first period as, unlike males, the injury rate was quite stable from 2002 to 2007 with values ranging from 15 to 22 per 1,000. Similar to males, the female injury rate fell to a low of 11 per 1,000 in 2009 to rise again thereafter with values of 15 to 18 per 1,000.

Overall the time series data suggest that male injury rates have declined more steeply than female injury rates which contributed to narrowing the gap between male and female injury rates over the period.

It is likely that these gendered patterns reflect at least in part the very sharp fluctuations in predominantly male sectors of the workforce, such as construction which accounted for a startling 21 per cent of male employment in the last stages of the construction bubble in 2007 (see McGinnity et al., 2014). In contrast, health was the largest sector for women accounting for 19 per cent of female employment in 2007. The role of sectoral segregation in accounting for gender differences is examined in the following chapter.

FIGURE 3.3 Rate of Total Injury (0+ days) per 1,000 Workers by Gender 2002-2012 (CSO)

Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.

3.2 TRENDS IN WORK-RELATED ILLNESS

The QNHS module collects information on illnesses that respondents believed were caused or made worse by work. The most recent figures suggest that over 50,000 workers experienced such illness in 2012. The rate of illness causing four or more (4+) days absence from work has increased from 10.6 cases per 1,000 workers in 2011 to 14.8 in 2012 (Figure 3.4). This was the fourth year in a row in which an increase in the illness rate was recorded. The trend is somewhat different for illnesses causing absences of less than four days.

Both illness rates fell in 2009 before increasing in 2010 and 2011. For absences of four or more days this increase continued in 2012 while the rate fell for absences of less than four days. Indeed there is a distinct shift in the proportion of illnesses

falling into 4+ days category in 2012[25] which suggests that the changes to the survey question on duration are playing a role. For this reason it is better to focus on the overall rate for 2012.

TABLE 3.3 Number and Rate of People Suffering Work-Related Illness 2008–2012

	2008		2009		2010		2011		2012	
	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000	N	Rate per 1,000
Total in employed[1]	2,128,325		1,961,275		1,882,175		1,850,050		1,851,425	
Total suffering illness	40,874	19.2	30,593	15.6	38,704	20.6	48,436	26.2	50,210	27.1
0-3 days' absence	24,047	11.3	18,328	9.3	20,856	11.1	28,748	15.5	22,735	12.3
4+days' absence	16,827	7.9	12,265	6.3	17,848	9.5	19,688	10.6	27,474	14.8
Days lost due to illness	751,600		463,700		704,494		595,951		N/A	

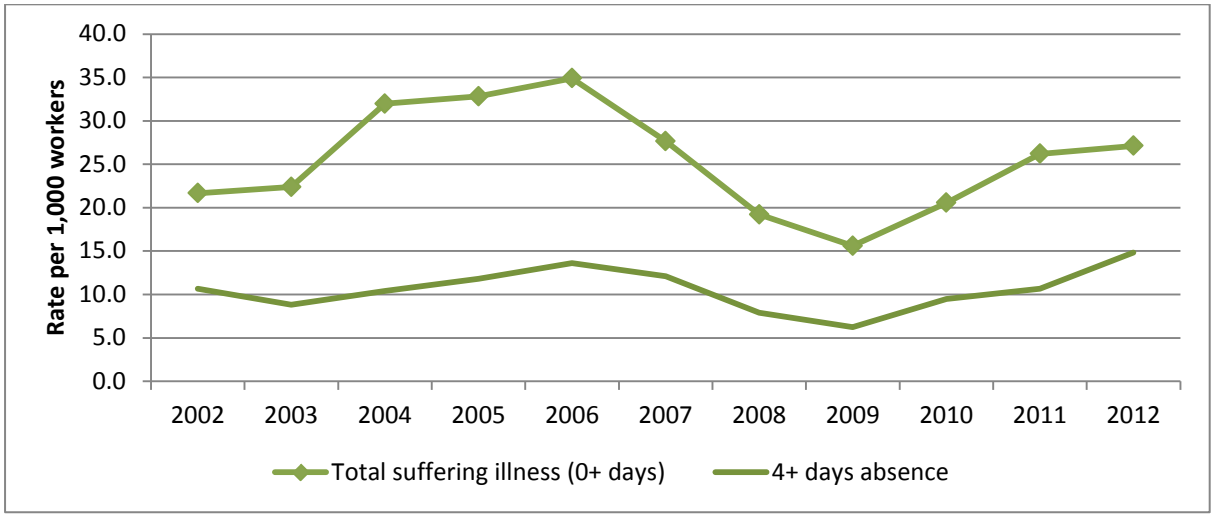
Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.
Note: The employment figures relate to the average across the four relevant quarters.
N/A: Not Available.

Figure 3.4 presents the trend in illness rates per 1,000 workers for the period 2002 to 2012. The pattern is very similar to that found for the injury rates. The overall illness rate (0+ days absence) increased from 22 to 35 per 1,000 between 2002 and 2006. The injury rate then fell dramatically to 16 per 1,000 in 2009 to then increase steadily to 27 per 1,000 in 2012, a higher level than in the earlier period of 2002-2003.

The trend for the illnesses resulting in four or more days of absence, while following the same pattern, is less pronounced as then for the overall illness rate. The variation is more modest particularly during the first part of the period as the rate increases from 11 per 1,000 in 2002 to 14 per 1,000 in 2006. The drop in longer term illnesses between 2007 and 2009 is also more modest, and there is a subsequent increase from 2010 onwards.

[25] In 2012, 55 per cent of illnesses are in the 4+ category compared to between 40 per cent and 46 per cent in the period 2008-2011.

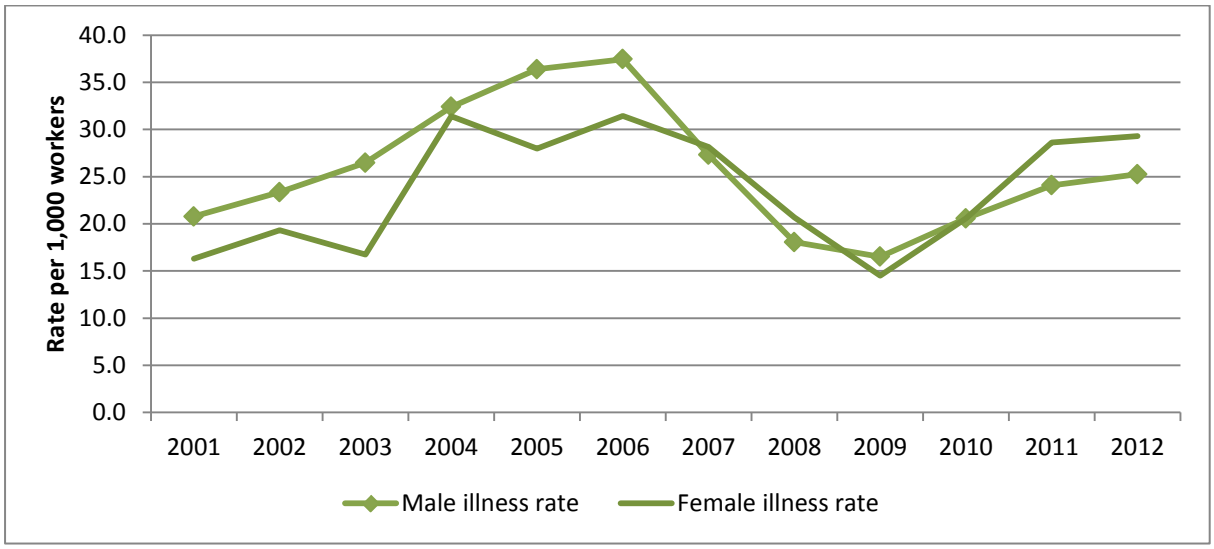
FIGURE 3.4 Rate of People Reporting Illness per 1,000 Workers 2002-2012 (CSO)



Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.
Note: The figures for 2012 are likely to be affected by changes in the question wording/coding on the duration of absence.

In 2012 women experienced a higher illness rate (29 per 1,000 workers) compared to men (25 per 1,000 workers). This continues a pattern which emerged in 2011 (see Figure 3.5). In the boom period 2002 to 2006 illness rates were generally higher among men. Both groups have experienced the same pattern of rising illness rates between 2002 and 2006. Then male and female illness rates fell sharply at the same pace to reach similar low levels of 17 per 1,000 and 15 per 1,000 respectively in 2009.

FIGURE 3.5 Rate of Total Illness (0+ days) per 1,000 Workers by Gender 2002-2012 (CSO)

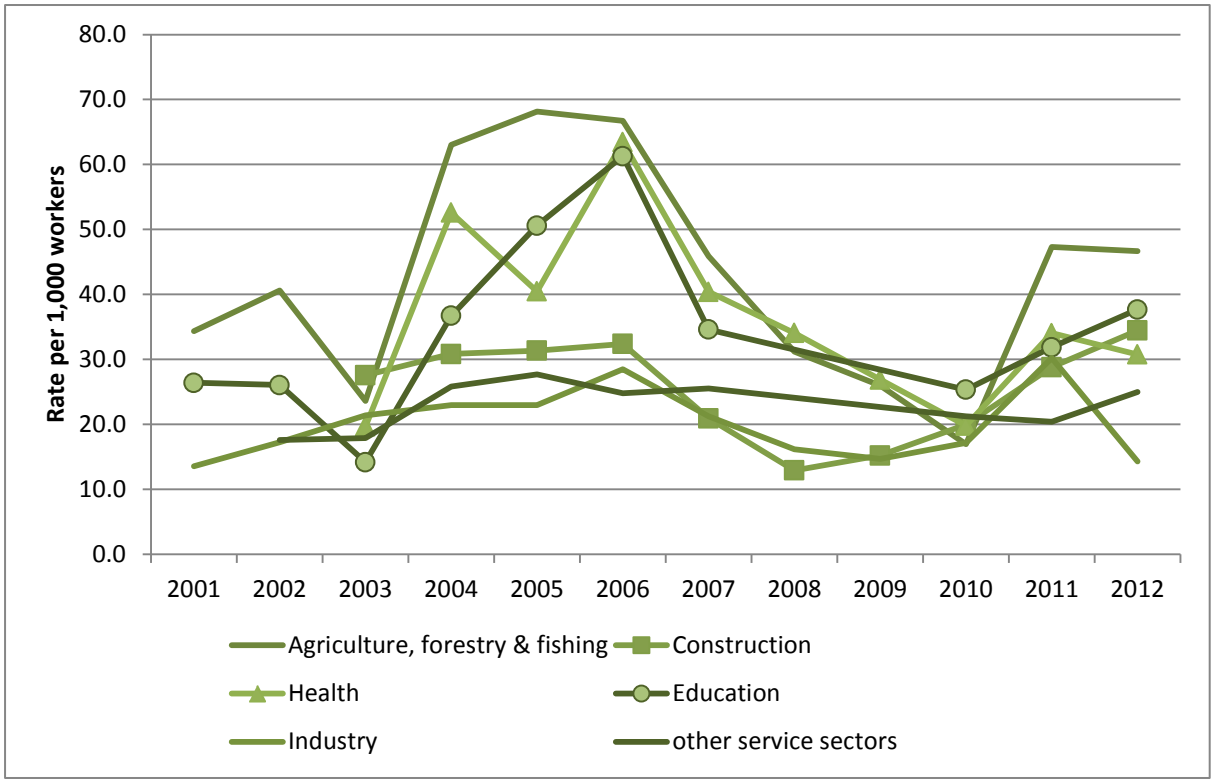


Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.

3.3 TRENDS IN ILLNESS RATES BY ECONOMIC SECTOR

The three sectors with the highest illness rates in 2012 (0+ days lost) were agriculture, forestry and fishing (47 per 1,000 workers), information/ communication (41 per 1,000) and education (37 per 1,000 workers). However there is a substantial degree of variation in the sectors that exhibit the highest illness rates each year. Based on analysis of the last five years (2008-2012) we identified the sectors that most often appeared in the 'top five'. The 'top five' sectors are, agriculture/forestry/fishing, construction, health, education and industry and they represent on average 53 per cent of all work-related illness cases over the period 2008 to 2012.The trends by sector (see Figure 3.6) show a good deal of fluctuation over the period observed. There are particularly sharp peaks and troughs in agricultural sector but this sector has one of the highest illness rates throughout the period.

FIGURE 3.6 Rate of Total Illness (0+ days) per 1,000 Workers by Sector 2002-2012 (CSO)



Source: QNHS micro-data, weighted to reflect population statistics. Authors' analysis.
Note: Agriculture includes forestry and fishing sectors.

3.4 SUMMARY OF RESULTS

This chapter has highlighted trends in non-fatal injury rates and work-related illness rates over the 2000s. This period encompasses a phase of rapid economic and employment growth and one of steep economic decline.

- There was a high of 64,000 work-related injuries in 2007 at the peak of the economic boom characterised by high level of employment. Work-related injuries declined rapidly with the recession to a low of 32,000 in 2009.
- The injury rates per 1,000 workers were the highest over the period 2004 to 2007, the lowest in 2009 before increasing again in 2010-2011.
- Over the period 2001 to 2007 there was a rise of injury rate (0+ days) per 1,000 workers for male but not for female. Overall male injury rate (0+ days) per 1,000 workers is higher than female injury rate but the gap has narrowed since the recession.
- There are large variations of injury rate (4+ days) per 1,000 workers across economic sectors but the gap has narrowed over time since the recession. The highest rates are in agriculture/forestry/fishing, construction, health, industry and transportation and storage.
- The highest number of reported work-related illnesses of 72,000 was in 2006.The lowest number of 31,000 was in 2009 at the beginning of the recession.
- The rate of illness per 1,000 workers peaked in 2006. Rates then decreased until 2009 and have risen subsequently until 2012.
- Over the period 2001-2006 there was an increase of illness rate (0+ days) per 1,000 workers for male and female. During this period, the male illness rate was higher than the female illness rate but the gap disappeared in the recession and early recovery periods.
- The illness rates (0+ days) per workers are the highest in five economic sectors, agriculture/forestry/fishing, construction, health, education and industry. These sectors represent on average 53 per cent of all illnesses over the period 2008 to 2012.

Chapter 4

The Determinants of Work-Related Injuries and Illnesses in Ireland 2001–2012

4.1 INTRODUCTION

This chapter draws on data from the QNHS special modules to address the following questions:

- What factors are important in accounting for the risk of work-related injury and illness?
- How has the likelihood of experiencing a work-related injury or illness changed over the period 2001 to 2012?

In addressing these questions we focus on five sets of factors: personal characteristics (gender, age, and nationality); sector and job characteristics (contract type, working hours, scheduling/shift patterns and job tenure, including occupation for the most recent years); period effects; and changes over time in the inspection rate. Using logistic regression analysis we examine the factors that influence the likelihood of work-related illness and injury and assess which are most salient.

In Chapter 3 we saw injury and illness rates differed significantly by gender, while the annual statistical reports on workplace injuries and illness suggest that age is also a relevant risk factor, especially for illness (e.g. HSA, 2014a, 2013b). We also hypothesise a higher risk of work-related injury among migrants, on the basis that this group are likely to occupy more risky jobs in the labour market due to their weaker bargaining positions, and lower levels of Trade Union protection. For example, McGinnity et al. (2011) show that migrants are more likely to occupy temporary positions. Migrants are also found to be over-represented in economic sectors that have higher than average injury rates: construction and accommodation/ food (McGinnity et al., 2014, p16).

As highlighted in the previous chapters, economic sector has also been found to play a very significant role in patterning risks of occupational injury (both fatal and non-fatal) and illness. Work-related injury and illness have also been found to vary with job characteristics such as occupation, job tenure, working hours and

working times. Previous research has found that longer hours of work are associated with a higher risk of work-related injury and illness although the findings are not unanimous. A review of research published between 1995 and 2002 found that two of the three studies that examined long working weeks, found an higher on-the-job injury rate (Caruso et al., 2004). The third study, which examined work-related fatalities over a 20-year period, found that there was no association with long working hours (over 50 hours a week) (Akerstedt et al., 2002). A number of studies reviewed found that extended work shifts i.e. long hours per day, were associated with higher injury risks. Injuries were found to be more common in the last hours of the shift. Two laboratory studies showed a decline in performance with extended shifts but no decline in alertness/reaction time was found in four field studies. Caruso et al. (2004) also reviewed studies of the relationship between long hours and illness (including cardiovascular, musculoskeletal, fertility, pre-term births, perceived general health and fatality). Long hours were associated with increased morbidity and mortality in eight of 12 studies.

The analysis also considers the relationship between employment contract and occupational injuries and illness. A key distinction is between self-employment and employee status. Fatal injury statistics consistently show a higher risk among self-employed workers. For example in 2012, 46 per cent of fatal injuries occurred among the self-employed (HSA, 2013b) although self-employment accounted for only 16 per cent of employment overall. The rates of non-fatal injury among the self-employed have been more difficult to establish due to the very low reporting of injuries to the statutory agencies and the rates derived from the QNHS have not been routinely reported. However analysis of the 2002 QNHS module found higher rates of non-fatal injury among self-employed men (without employees), while self-employed women had significantly higher illness rates than female employees (HSA, 2005). Yet these injury risks may be a function of the job or sectors that are occupied rather than self-employment per se and the models below can test whether this is the case.

It is also well established that many other worker and organisational characteristics overlap, for example the self-employed work longer hours, part-time working is more common among women, and shift work is more common in the manufacturing and health sectors. However, there has been little systematic research on how these risk factors combine or which factors dominate in explaining injury patterns in the Irish workforce.

A key research question is the extent to which work-related injury and illness are influenced by time period, in particular whether the risks are declining or rising

over time and how they are related to the prevailing economic conditions. The Irish experience of rapid economic growth followed by a sharp recession provides an interesting test case for testing such theories. Given the substantial changes in the sectoral distribution of employment and in the composition of the work-force outlined in Chapter 1, it is essential to examine the effect of period net of these factors.

The models will also examine the significance of changes in the injury illness rates over time by examining how the effect of year is altered when other characteristics are entered into the model.

4.2 MEASURES OF ECONOMIC SECTOR AND JOB CHARACTERISTICS

Information on how work-related injuries and illness are measured in the QNHS is outlined in Chapter 2; here the measures of worker and workplace characteristics are described. The economic sector of activity is defined using the NACE Revision 2 categories (see Appendix Table A1.5 for full listing). The information for the early years of the QNHS has been back-coded to the new categorisation. The category 'Agriculture' combines agriculture, forestry and fishing, and 'Industry' combines manufacture, mining and energy supply, water supply, sewerage and waste management (NACE C, D, E, and F). A number of service categories are also combined Financial and Insurance, Real Estate, Information and Communication, Professional and Technical activities, Public Administration, Education, Arts and Other services (NACE J, K, L, M, O, P, R, S). These service sectors were found to have similar injury rates in previous analysis (not shown) and are used as the reference group in the models that follow. Three additional service sectors – health services, retail/wholesale and accommodation/food are examined separately as these have had distinctive injury rates and/or account for a large proportion of employment (see Chapter 1).

The hours of work are derived from a question on usual hours worked per week, excluding breaks but including regular overtime. Answers have been grouped into categories for our analyses. While long hours of work have been frequently included in analyses of work-related injury and illness risks, Dembe et al. (2005) note that the analyses often do not control for the fact that those working longer hours are exposed to any hazards for a longer time, and hour for hour there may be no difference in risks. To adjust for this Dembe et al. use longitudinal information for workers in the US to construct standardised person months. Davies and Jones (2005, p54) construct full time equivalent (FTE) rates; we adopt this approach. The unadjusted figures show that those working over 50 hours and those working variable work hours have the highest injury rates (Table 4.1).

However when we calculate a FTE rate, using the sample mean of 35.6 hours per week, we find that hour for hour it is those on the shortest hours who have the highest risk. These results make no adjustment for the distribution of these workers across sectors and jobs, this is done in Model 8 below (Table 4.7).[26]

TABLE 4.1 Injury Rates by Usual Hours of Work Uncorrected and Full-Time Equivalent (FTE)

	Uncorrected	FTE	% of Employed
Variable hours	3.0	3.0	10.9
1 to 9 hours	1.3	7.3	2.2
10 to 19 hours	1.8	4.5	6.8
20-29 hours	1.5	2.4	12.5
30-39 hours	2.4	2.3	38.0
40-49 hours	3.1	2.6	21.6
Over 50 hours	3.2	2.0	8.0
Total	2.5	2.7	100.0
N	198,646	198,646	198,646

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: All years 2001-2012 pooled. Includes all injuries including those where there was no absence from work.

Job tenure is derived from information on the year and month in which the respondent started their current job. Month of start is only collected from respondents who took up their current job within the previous two years. This information was combined with (imputed) date of interview to calculate job tenure.[27] Examining the relationship between job tenure and injury risk is complicated by the issue of length of exposure (to work-related hazards). In Table 4.2 below we outline the injury risk by tenure. Taking those with a tenure of one month or less we see that 1.4 per cent of the group reported an injury. However this is effectively a monthly risk for this group, since they were only exposed to one month of employment. Following the method used by Davies and Jones (2005) we adjust the rates for those employed for less than one year to produce an annual equivalent rate. The results in Table 4.2 show that with this adjustment new recruits have a significantly higher injury risk, amounting to a 16.8 per cent annual equivalent rate for those who have been in their jobs for one month or less.

[26] The models are logistic regressions of whether or not the respondent experienced an injury (or illness). Therefore to adjust for full time equivalence the weights of those working shorter than average hours who experienced an injury were weighted upwards and those on longer hours who experienced an injury were weighted downwards. Accordingly the other coefficients in the model should not be interpreted and the results should be seen as illustrative.

[27] For a small number of cases where the injury did not occur in the current job the tenure information will be inaccurate.

It is also clear that the proportion of new recruits amongst the employed increases in times of economic growth when employers hire more workers and declines during recession (see Table 4.3). The proportion of employees with less than a year's experience on the job falls from a peak of 21 per cent in 2004 to a low of 11 per cent in 2009.

TABLE 4.2 Injury Risk by Job Tenure QNHS 2001-2012 (pooled)

	Unadjusted Injury Rate %	Adjusted (Annual Equivalent Rate) %
1 Month or less	1.4	16.8
2 Months	2.3	13.7
3 Months	2.7	10.9
4 Months	1.7	5.0
5 Months	2.4	5.8
6 Months	1.9	3.9
7 Months	2.5	4.3
8 Months	2.3	3.4
9 Months	2.4	3.3
10 Months	2.4	2.9
11 Months	2.6	2.8
12 Months	2.2	2.2
13 months to 2yrs	2.5	2.5
3 to 5 years	2.9	2.9
Over 5 years	2.4	2.4
Tenure missing	3.1	3.1
All	2.4	
N	200,839	

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: includes all work-related injuries including those that did not result in any absence

TABLE 4.3 Job Tenure by Year 2001-2012 (QNHS)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
< 6 months	8.6	8.1	9.6	11.4	9.1	10.3	10.2	7.7	6.0	6.3	7.2	6.7
6-12 months	9.8	8.1	9.1	9.5	9.1	9.5	9.6	7.0	4.6	5.8	5.5	7.1
1-2yrs	11.9	10.8	11.2	9.9	10.4	10.1	10.3	11.0	9.9	7.0	7.4	7.8
3-5 years	22.3	25.0	25.4	24.1	20.5	21.1	20.3	22.2	24.5	23.5	20.2	18.6
> 5 years	47.4	48.0	44.7	45.1	50.9	48.9	49.6	52.0	55.0	57.3	59.7	59.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.

Non-standard working hours are also captured in the QNHS, including night work, shift work and evening work. Evening work was found to have no significant relationship with the probability of injury and therefore was removed from the model. While there was a significant overlap between shift work and night work, we found that 11 per cent of workers were involved in just one of these two arrangements, e.g. shift workers who did not work nights and therefore both types of working arrangements were included.

In terms of contract type we include a distinction between the self-employed and employees. Whether the employment contract is permanent or temporary provides some insight into the level of security of tenure and how this is related to injury risks. However, the nature of employment regulation in Ireland means that permanent contract does not have the same protection as in other employment regimes (Layte et al., 2008). Previous research has found that the levels of subjective insecurity were very high across the Irish workforce during the recession (Russell et al., 2014). The question on the permanency of contract is only asked to employees and so is only tested in a separate model for employees. Size of organisation is not currently included in the models because of unresolved issues in the coding of this information over time.

4.3 MODELLING STRATEGY

The factors influencing occupational injury and illness are examined by means of logistic regression models. These models are used when the dependent variable is dichotomous (i.e. has only two categories e.g. yes/no). In the following models the dependent variable is equal to one when a work-related injury was experienced in the past 12 months, and zero if no injury occurred. All injuries are included regardless of the duration of the absence, because duration of absence is also structured by factors such as coverage by social insurance and private

insurance. For example a report by the HSA (2005) found that the duration of absence was significantly lower among the self-employed and suggests that the most plausible explanation is the lack of income support for self-employed workers during absence. Including cases of injury where no absence was recorded means that this bias is reduced although it will not be eliminated as longer absences are more likely to be recalled. Similarly in the illness model, any work-related illness is recorded including those involving zero days absence.

Over three quarters of cases of work-related injury or illness involve absences of less than ten days and most frequently workers are absent for less than one day (Table 4.4).

TABLE 4.4 Duration of Absence Associated with Work-Related Injury or Illness, 2001-2011

	Injury %	Illness %
No days/ <1day	34.7	44.0
1 to 3 days	20.9	14.4
4 to 10 days	20.7	19.0
11 to 20 days	7.0	7.3
21 to 30 days	5.7	4.2
31 to 130 days	8.7	7.9
131 to 365 days	2.2	3.2
	100.0	100.0

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis. Duration of absence data were collected in a different format in the Q2 2013 module therefore data relating to the year 2012 are excluded.

Logistic regression results are reported as odds ratios, which represent the odds that an outcome (in this case injury or illness) will occur given a particular characteristic, compared to the odds of the outcome occurring in the absence of that characteristic. For each characteristic a reference group is selected and the results show the odds of an illness occurring compared to the reference group. Odds ratios greater than 1 show that the characteristic increases the likelihood of the outcome, while values between 0 and 1 indicate that the characteristic reduces the likelihood of the outcome. The significance level indicates whether an odds ratio of the size reported is likely to be due to chance variation. In the case of continuous variables such as age, the odds ratio represents the effect of one unit increase (i.e. one year in the case of age) on the outcome of interest.

The models are estimated in a nested fashion so that we can examine how the effects of variables change when additional explanatory variables are added to

the model. For example, we can investigate whether the effect of recession period changes when economic sectors are held constant.

4.4 WORK-RELATED INJURY: MODEL RESULTS

Injury and the Business Cycle

The initial model included time period as the only explanatory variable (Model 1). A number of different specifications were tested and it was found that there is a clear distinction between the period of economic growth in 2001-2007 and the period of economic recession 2008 and 2012, therefore the time variable was grouped into these two periods.[28]

The results show that there is a significant fall in the odds of work-related injury in the recession period. This starts as a 27 per cent decline in the odds of injury compared to the boom period when no other factors are taken into account (Model 1). Model 2 shows that about one fifth of the decline in injuries during recession was accounted for by changes in the composition of the workforce in terms of gender, age, nationality and sectoral distribution: in this model there is a 21 per cent lower odds ratio of injury in recession. When work characteristics (e.g. hours, tenure, shift work, night work) are controlled the recession effect remains unchanged (Model 3). This result suggests that changes in these work conditions within sectors does not explain the lower level of injuries in recession compared to the boom.

As an alternative test of the economic cycle effect we construct a variable for the percentage change in employment each year within the sector where the respondent is employed. This variable is added instead of the recession/boom identifier and the interactions between period and sector (see below). The analysis shows that each percentage increase in employment within the sector leads to a 1 per cent increase in the odds ratio of injury (see Appendix Table A3.2).

Given the uncertainty around the data for 2009, we conducted a robustness check by dropping 2009 from the models. The recession period effect and the interactions between recession and period were maintained. The yearly percentage change in employment by sector also remains significant when the

[28] Other specifications tested included year dummies, a continuous year variable and squared year term. We also substituted the year term with the annual unemployment rate, however while the effects were in the same direction they were weaker in magnitude. The model using year dummies are included in the appendix. A robustness check dropping the year 2009 was also conducted and the effects of period did not change substantially.

observations for 2009 are dropped from the model (see Appendix Table A3.3 for results).

Personal Characteristics and Injury Risk

Female workers have a 38 per cent lower odds of occupational injury compared to male workers (Model 3). This gender difference is not explained by the segregation of men and women into different industrial sectors nor to differences in the hours worked by men and women since these characteristics are held constant in the model. It is possible that women and men experience different injury rates *within* industries due to variation in occupations. When we can control for occupation (in the 2010-2012 period only) we find that the effect of gender is reduced but still significant: women have an odds ratio that is 25 per cent lower than men (Table 4.9, Model 10).

Contrary to expectations non-Irish nationals are found to have a *lower* injury risk than Irish nationals. One issue behind this unexpected finding is that migrants are not a homogenous group, encompassing both professionals and low skilled workers, those from English speaking countries and those who may have language difficulties that could affect their safety in the workplace. However the size of the migrant sample means that we cannot distinguish between these groups. For the years 2010-12 when we can control for occupation there is no significant difference between migrant and non-migrant workers (Model 10 below). It is also possible that more vulnerable groups of migrant workers, such as those employed in the informal sector are not picked up in the QNHS (see McGinnity et al., 2011). The lower rate of injury for non-Irish workers may also be affected by differences in exposure since the migrant group are over-represented among those with job tenure of less than one year. This interpretation is supported by the finding that in the model confined to workers with more than one year's tenure showed there is no difference between the non-Irish and Irish groups (Models 11 and 12).

The final personal characteristic investigated is age. The models confirm cross-sectional findings that injury risk declines with age. Further research could examine whether the relationship between age and injury differs across different industries or occupations.

TABLE 4.5 Logistic Regression of Injury Risk (0+ Days Absence) QNHS 2001-2012

	Model 1		Model 2		Model 3		Model 4		Model 5	
	odds	sig	odds	sig	odds	sig	odds	sig	odds	sig
Ref=Boom '01-07										
Recession '08-12	.726	.000	.79	.000	.78	.000	.85	.008	.91	.193
Female			.54	.000	.62	.000	.62	.000	.62	.000
Age			.99	.000	.99	.000	.99	.000	.99	.000
Non-Irish			.89	.014	.86	.003	.87	.003	.87	.003
Sector ref=service										
Agriculture			1.91	.000	1.75	.000	1.92	.000	1.92	.000
Industry			1.50	.000	1.36	.000	1.50	.000	1.51	.000
Construction			2.17	.000	2.32	.000	2.52	.000	2.52	.000
Retail and wholesale			1.31	.000	1.35	.000	1.39	.000	1.39	.000
Transport			1.85	.000	1.53	.000	1.42	.000	1.42	.000
Accomm. and food			1.81	.000	1.52	.000	1.56	.000	1.56	.000
Health			2.19	.000	1.84	.000	1.75	.000	1.75	.000
Ref: employee										
Self-employed					.97	.590	.98	.646	.98	.644
Job tenure ref >5yr										
< 6 months					.79	.000	.79	.000	.79	.000
6-12 months					.86	.014	.86	.016	.86	.015
13 months-2yrs					.98	.769	.99	.794	.99	.803
3-5yrs					1.15	.000	1.15	.000	1.15	.000
Hours ref <30hours										
Hours vary					1.32	.000	1.32	.000	1.33	.000
Hours 30-39					1.16	.002	1.16	.002	1.17	.002
Hours 40-49					1.36	.000	1.35	.000	1.36	.000
Hours 50plus					1.32	.000	1.31	.000	1.32	.000
Shift work					1.63	.000	1.63	.000	1.63	.000
Night work					1.22	.000	1.22	.000	1.22	.000
Agric*recess							.75	.031	.75	.029
Indust *recess							.73	.002	.73	.002
Con*recess							.75	.009	.75	.009
Retail*recess							.94	.541	.94	.541
Transport*recess							1.22	.132	1.22	.132
Accom*recess							.93	.582	.93	.588
Health*recess							1.11	.316	1.11	.311
Inspect rate									.95	.010
constant	.029	.000	.036	.000	.026	.000	.02	.000	.035	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.

Note: Dummies were also include for missing information on tenure, missing on shift work and missing on night work. As the missing values for shift and night work are concentrated in certain years these variables are dropped in model 5. Shading indicated the variable was not included in the model.

Economic Sector

The odds of experiencing a work accident is strongly linked to economic sector (Model 2). Compared to workers in the 'rest of services' sector (comprising of sectors J, K, L, M, O, P, R, S) and holding gender, age and nationality constant:

- Those in the construction sector and the health sector are more than twice as likely to have a work injury.
- Those in the agriculture sector, accommodation/food and the transport sector are 1.9 times as likely to experience an injury.
- Industry sector workers are 1.5 times more likely to have an injury.
- Workers in the retail/Wholesale sector are 1.3 times more likely to experience an injury.

The effects of economic sector on injury risk are somewhat moderated when working conditions such as hours, job tenure, shift work and night work are controlled (Model 3), suggesting that some of the differences between sectors can be explained by differences in the prevailing conditions within those sector. Nevertheless, most of the sector effects remain and the risk associated with construction work becomes even higher.

In Model 4 we test whether the period effect differs across economic sectors. The results show that the fall in injury risk in the recession period was particularly strong in the agricultural sector, the industry sector, and the construction sector. For ease of interpretation the period effects for each sector obtained from separate sector models are presented in Table 4.6. These figures show that the period effect is not significant in the transport sector or the health sector. It is noteworthy that employment in the health sector continued to grow through the recession period and therefore this result does not contradict the pro-cyclical relationship between injuries and growth.

TABLE 4.6 Effect of Recession (2008-2012) versus Boom (2001-2007) on Injury within Sector

	Odds	Sig.	N Unweighted
Other service (including finance, Public admin, education etc.)	.849	.009	12,944
Agriculture	.612	.000	12,340
Industry	.606	.000	29,367
Construction	.643	.000	16,390
Retail	.769	.003	27,065
Transport	1.085	.488	9,257
Accommodation/ food	.806	.051	12,091
Health	.954	.580	22,984

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: These coefficients are taken from separate models for each sector, controlling for all the variables in Model 3 above.

Work Characteristics

Controlling for sector, personal characteristics, and other working conditions we find that the self-employed are no more or less likely to have a work-related accident than employees (Model 3). This suggests that the higher rate observed among the self-employed is due to their higher concentration in more risky sectors (such as construction and Farming) and work practices such as long working hours.[29] Working alone may be a further risk factor for the self-employed but the QNHS data do not contain information on whether the respondent was alone when the injury occurred.

The analysis shows that longer hours of work are associated with a higher risk of work-related injury (Model 3). Compared to those working less than 30 hours per week, those working 30 to 39 hours per week were 1.2 times more likely to have experienced an accident, while those working more than 40 hours per week were 1.3 times more likely to have had an accident. We found no difference between those working 40 to 49 hours and those working more than 50 hours per week. The risk of work-related injury was also found to be higher amongst those who had variable working hours. This has not been found in previous research and may be because an unpredictable schedule leads to greater fatigue or perhaps those working variable hours are more likely to be working with different co-workers which might introduce greater uncertainty into tasks and processes. Further investigation would be needed to identify the mechanisms involved.

[29] Within our sample the self-employed were found to work an average of 46.3 hours per week compared to a mean working week of 34.6 hours among employees. A high proportion (59 per cent) of those working over 50 hours per week are self-employed. The self-employed are also more likely to appear in the variable hours category – 37 per cent of the self-employed report that their hours are variable compared to 5 per cent of employees.

In the main model no adjustment is made for exposure. In Table 4.7 we examine the effect of adjusting the figures for full-time equivalence. This has the effect of increasing the odds of injury for those working less than 35.6 hours per week and decreasing the odds of injury for those working longer than average hours. These illustrative results suggest that those working less than ten hours per week have the highest risk of injury per hour.

TABLE 4.7 Injury Risk With and Without Adjustment for Full-Time Equivalence

	Model 7 no adjustment		Model 8 FTE	
	Odds Ratio	Sig	Odds Ratio	Sig
Hours vary	1.13	.018	1.20	.001
Less than 10 hours	.71	.013	4.20	.000
10-19 hours	.96	.611	2.57	.000
20-29 hours	.83	.001	1.39	.000
30-39 hours (ref)	**1:00**		**1.00**	
40-49 hours	1.16	.000	1.05	.240
50 plus hours	1.13	.030	0.75	.000
Constant	.030	.000	.032	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Models also control for period, gender, age, nationality, sector, tenure, self-employment, shift/night work. Results are indicative only. All years pooled.

Independently of hours worked and sector, those working a shift pattern were found to have a 1.6 times greater risk of injury compared to those not working in shifts. Similarly, those working nights were 1.2 times more likely to have had an accident than those not working nights independent of the economic sector occupied. For those working shifts at night these odds should be multiplied (1.6 times 1.2) which results in a 1.9 times greater odds of injury compared to those involved in neither practice.

Model 3 also shows that workers with shorter job tenures (less than one year) are significantly less likely to have had a work accident than those who have been in their jobs for over five years. Only those with tenures of three to five years are found to have an elevated injury risk. However these figures make no adjustment for exposure (see Section 3.2 above). We used the method outlined above to create an equivalent yearly injury rate for those in jobs for less than one year; this was used to re-weight the data. The model results using this adjusted weight are presented in Table 4.8 below (Model 9). The results suggest that, controlling for other factors; new recruits with less than six month's experience are 4.3 times

more likely to have a workplace accident than those who have been in their jobs for more than five years. Those with six to 12 month's tenure are 1.3 times more likely to have an accident. This correction adjusts the underlying data and the results are illustrative only.

TABLE 4.8 Model of Injury Adjusted for Exposure Due to Job Tenure (Full-Year Equivalence)

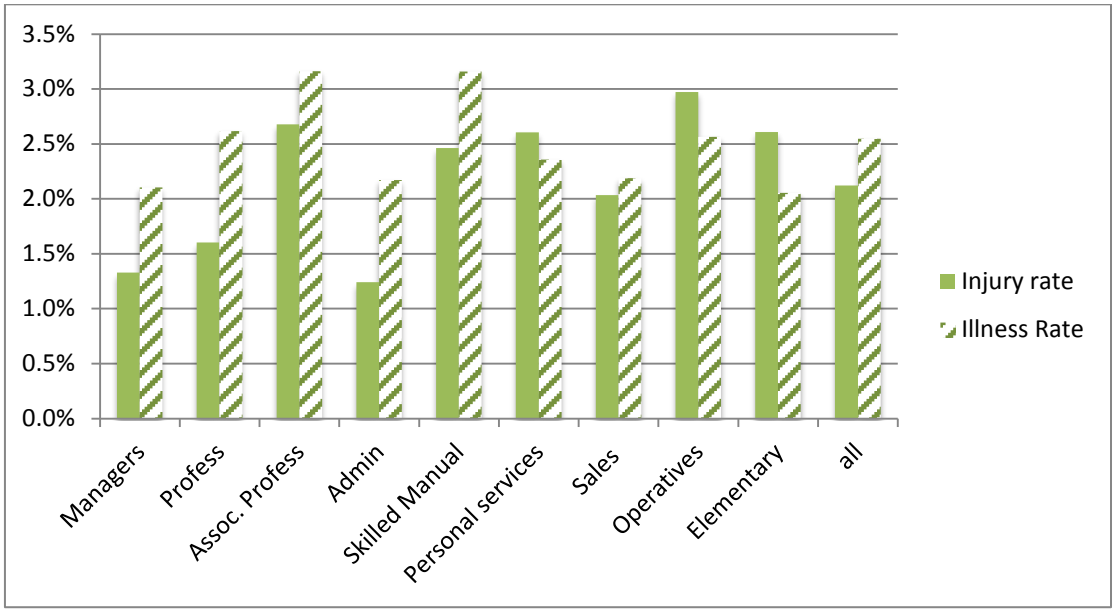
	Model 9	
	Odds Ratio	Sig.
Job tenure ref >5yr		
< 6 months	4.28	.000
6-12 months	1.29	.000
13 months-2yrs	1.03	.549
3-5yrs	1.19	.000
Constant	.02	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Model also controls for period, gender, age, nationality, sector, hours, self-employment, shift/night work. Results are indicative only.

Occupation

The work conditions outlined above will capture some of the variation across occupations, however exposure to work-related injuries and illness is still likely to be influenced by occupation net of these characteristics and sector. The data contain information on respondents' occupation at the time of the injury. The classification of occupations used by the CSO was updated in 2010, which means that there is a break in series. Therefore we re-estimate the models but only for the years 2010-2012 including the occupational information. As these years are all in the recession period we do not assess the business-cycle effects. Figure 4.1 shows the injury and illness rates by occupational groups for the period 2010-2012.

FIGURE 4.1 Work-Related Injury and Illness (%) by Occupational Groups 2010-2012 (pooled)



Source: QNHS.
Note: Includes all injuries (0+ days absence) and all work-related illness 0+ days absence). SOC2010.

Over the period 2010-2012, work-related injuries were most common among 'operatives', this group consists of semi-skilled manual jobs such as assembly workers, fork-truck drivers, scaffolders and sewing machinists (see Office for National Statistics 2010 for further details). Associate professional/technical workers had the next highest injury rate, this includes a wide group of workers including paramedics, artists, sports workers, police officers and health and safety officers. Skilled manual workers, personal service workers and those in elementary occupations all record higher than average levels of injury. The lowest levels of injury are recorded by managerial and administrative workers. This pattern of results is largely maintained when other factors are controlled (Table 4.9, Model 10) however the higher injury risk faced by associate professional group and by the skilled manual group becomes stronger while the operatives group become less distinctive. The pattern of sector differences is also maintained when occupational information is included in the model and there is only a very marginal reduction in the odds ratios for sector and the other work characteristics.[30] The biggest change occurs for long working hours (50 hours plus) which rises from odds of 1.54 to 1.64, suggesting that there may be an interaction between hours, occupation and injury outcomes.

[30] Results from the models showing the reduction of the odds ratios for sectors and the other work characteristics are not presented here but are available from the authors.

TABLE 4.9 Regression Model of Injury (0+days) 2010-2012 Including Occupation

		Model 10	
		Odds Ratio	Sig.
	Female	.774	.002
	Age	.992	.008
	Non-Irish	.940	.512
Sector:	Agriculture	1.442	.036
Ref: Services	Industry	.990	.931
	Construction	2.237	.000
	Retail and wholesale	1.229	.080
	Transport	1.807	.000
	Accommodation and food	1.462	.006
	Health	1.545	.000
Hours:	Hours vary	1.285	.072
Ref: <30hours	30-39 hours	1.461	.000
	40-49 hours	1.731	.000
	50 plus hours	1.644	.001
	Shift work	1.909	.000
	Night work	1.300	.002
	Self-employed	.941	.577
Occupation	Manager	.712	.050
Ref: professional	Assoc. profess/technical	1.475	.001
	Administrative	.917	.554
	Sales	1.355	.047
	Personal services	1.201	.157
	Skilled manual	1.660	.000
	Operatives	1.274	.089
	Elementary	1.335	.026
	Constant	.013	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Model also controls for tenure.

Inspection Rate

In Model 5 we test the effect of the annual inspection rate per 1,000 workers on the likelihood of a work-related injury (as described in Table 1.3 above). A higher inspection rate is associated with a significant decline in the likelihood of work-related injury. This result suggests that the enforcement of health and safety regulations can have a positive effect on reducing injuries. As this variable is assessed on an annual basis we also checked that this result was robust when the observations for 2009 were removed from the model (as this year is an outlier). We found that the inspection rate remained significant in the model with annual

employment changes by sector but not in the model using the dichotomous boom/recession indicator (see Appendix Table A3.3).

One of the hypotheses linking workplace injuries to the business cycle, suggested that periods of economic expansion are more dangerous because of the higher proportion of new recruits. The period effects we observe are consistent with this hypothesis but in order to test this proposal more directly we examine whether the period effects weaken or disappear when new recruits are excluded from the analysis. On the contrary, we find that injury rates are still lower in the recession period (and higher in the growth period) when the analysis is confined to those with at least one year's job tenure: the probability of experiencing an injury are 21 per cent lower in the recession period (Model 11). Most of the interactions between recession and economic sector are also maintained when new recruits are excluded (model 12). The lower rate of injuries in recession is still found to occur in agriculture, industry and construction. The recession effect becomes insignificant for the reference services group and in the retail sector, but a comparison of the coefficient in Model 11 and in Model 5 suggests that this may be due to a decline in the number of cases rather than to a substantive change in the estimate. These findings suggest that other factors such as the pace of work/work intensity during a boom period or a greater reluctance to admit workplace accidents in recession are playing a role in the relationship between economic conditions and injury. Our alternative measure of business-cycle effects, the percentage annual change in employment, was also found to have a significant positive effect when the analysis excludes new recruits (see Appendix Table A3.4).

TABLE 4.10 Model of Injury Among Those with Job Tenures of Over 12 Months

	Model 11		Model 12	
	Odds Ratio	Sig.	Odds Ratio	Sig.
Ref=Boom '01-07	1.00		1.00	
Recession '08-12	.789	.000	.894	.127
Female	.581	.000	.582	.000
Age	.989	.000	.989	.000
Non-Irish	.944	.291	.947	.322
Sector ref=service[1]				
Agriculture	1.745	.000	1.900	.000
Industry	1.363	.000	1.501	.000
Construction	2.358	.000	2.547	.000
Retail and wholesale	1.353	.000	1.377	.000
Transport	1.435	.000	1.303	.006
Accomm and food	1.429	.000	1.443	.000
Health	1.922	.000	1.807	.000
Ref: employee				
Self-employed	.983	.729	.986	.780
Tenure ref: over 5 yrs.				
1 -2 years	.968	.553	.970	.576
3-5 years	1.133	.001	1.134	.001
Hours ref: Under 30				
Hours vary	1.253	.001	1.256	.001
30-39 hours	1.157	.007	1.157	.007
40-49 hours	1.310	.000	1.310	.000
50 plus hours	1.304	.000	1.298	.000
Shift work	1.650	.000	1.653	.000
Night work	1.209	.000	1.208	.000
Inspection rate			.963	.083
Sector by Period				
Agric *recess			.766	.053
Indust *recess			.752	.008
Con*recess			.764	.021
Retail*recess			.960	.723
Transport*recess			1.257	.106
Accom*recess			.976	.866
Health*recess			1.134	.253
Constant	.027	0.000	.033	.000
N	167,968		167,968	

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Shading indicates variables not included in the model.
[1] Services reference group is NACE sectors J,K,L,M,O,P, R and S (see Section 4.2 and Table A1.5 for details).

4.5 WORK-RELATED ILLNESS: MODEL RESULTS

Illness and the Business Cycle

As outlined in Chapter 1 the processes linking work-related illness and the economic cycle are likely to be similar to those linking patterns of workplace injury to growth and recession however the hypotheses relating to illness differ in some respects. High levels of work intensity and longer working hours that may accompany economic growth could increase the likelihood of work-related illness. Furthermore a reluctance for workers to report illness or take sick leave in periods of high job insecurity could lead to pro-cyclical relationship between illness and economic growth as observed for work injuries. However, there is considerable evidence that job insecurity itself is strongly associated with reduced mental and physical health (Ferrie et al., 2002, de Witte, 1999; Gash et al., 2007). Moreover while recession might discourage absenteeism, the measure of illness used here includes illnesses for which there was no absence from work. Therefore there is also reason to propose a counter-hypothesis that recession damages the health of workers.

Again models were tested using different specifications for the year/period variable and only the models grouping the period into pre-recession and recession period are presented here. The year by year patterns are less clearly mapped onto the boom and crisis periods compared to the injury patterns (see Appendix Table A3.1). Compared to the first year (2001) the likelihood of work-related illness is significantly higher in the years 2003 to 2007 inclusive, with the highest risks occurring in 2005 and 2006. In the first three years of the crisis period 2008 to 2010, the likelihood of illness fell back to the 2001 level (or below it as was the case in 2009). In 2011 and 2012 illness rates rose again and were significantly higher than the 2001 rate but did not return to the peaks seen in 2005-2006. When the years are combined into the dichotomous boom and recession periods, we find that the probability of illness was significantly lower in the recession period.[31]

In Model 1 (Table 4.11), the odds ratio of work-related illness is found to be 18 per cent lower in the recession period than in the period 2001-2007. Neither changes in workers' personal characteristics nor in the distribution of jobs by economic sector can account for the lower odds of illness in the later period, as the 'recession' effect remains strong and significant in Models 2 and 3. Controlling for work characteristics (Model 4) does not affect the result for the recession period. Model 5 demonstrates that the period effect is different for

[31] Given the uncertainty around the data for 2009, we conducted a robustness check in which 2009 was dropped from the models. The recession period effect was somewhat reduced (from .82 to .88 in Model 1 and from .90 to .93 in Model 3) but it remained negative and statistically significant.

men and women: the recession period was associated with a lower probability of illness for men, however for women the difference between the boom and recession period was less pronounced. This pattern may reflect differential gender effects of job losses and job pressure during the recession. While job losses were more concentrated among men, amongst those who 'survived' in employment, women experienced a greater increase in job pressure than men (Russell et al., 2014).

TABLE 4.11 Logistic Regression Models of Work-Related Illness

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Odds	Sig.	Odds	Sig.	Odds	Sig.	Odds	Sig.	Odds	sig.
ref: 2001-07										
Recession '08-12	.82	.000	.78	.000	.78	.000	.77	.000	.74	.000
Female			.95	.065	.96	.236	1.09	.018	.97	.517
Age			1.08	.000	1.08	.000	1.06	.000	1.06	.000
Age squared			1.00	.000	1.00	.000	1.00	.000	1.00	.000
Non-Irish			.81	.000	.84	.001	.86	.006	.85	.003
Sector ref: service										
Agriculture					1.65	.000	1.25	.000	1.20	.008
Industry					.91	.044	.87	.005	.82	.000
Construction					1.19	.002	1.22	.000	1.12	.054
Retail and wholesale					.85	.001	.85	.002	.74	.000
Transport					1.20	.006	1.03	.660	1.03	.732
Accomm. and food					.76	.000	.65	.000	.58	.000
Health					1.39	.000	1.25	.000	1.30	.000
Ref: Employee										
Self-employed							1.04	.428	1.05	.325
Job tenure >5yr										
< 6 months							.94	.302	.94	.329
6-12 months							.74	.000	.74	.000
13 months-2yrs							.85	.005	.85	.008
3-5yrs							1.00	.965	1.01	.840
Hours reference										
Hours vary							1.42	.000	1.43	.000
30-39 hours							1.08	.086	1.09	.050
40-49 hours							1.08	.123	1.09	.083
50 plus hours							1.39	.000	1.40	.000
Shift work							1.27	.000	1.27	.000
Night work							1.26	.000	1.25	.000
Female*recession									1.33	.000
Agric *recess									1.17	.220
Industry *recess									1.35	.003

Construct*recess									1.51	.001
Retail*recess									1.69	.000
Transport*recess									1.02	.905
Accommod*recess									1.58	.004
Health*recess									.87	.139
Inspection Rate									.89	.000
Constant	.028	0	.004	0	.005	.000	.005	.000	.01	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Notes: To avoid dropping cases, dummies were also included for missing info on tenure, sector shift work and night work but are not reported in the Table (only missing tenure is significant and negative).
Shaded area indicates not included in the model.

Personal Characteristics and the Experience of Work-Related Illness

Holding age, nationality, and time period constant (Model 2) and again in Model 4, when working contract and conditions such as hours of work, tenure, self-employment and working schedule are taken into account, women are more likely to experience illness than men. The gender by period interaction also shows that the higher rates of illness among female workers only emerged in the more recent period post-2007 (Model 5).

Consistent with previous findings, work-related illness is found to increase with age but the age effect becomes somewhat weaker at the top of the age scale as non-healthy older workers exit from employment.[32] Non-Irish nationals were found to have lower levels of illness than Irish nationals. This is not due to the lower age profile of migrants as age is held constant, but may be related to their higher educational profile which is not included, or to the exclusion of the most vulnerable migrant workers from the sample, or to differences in access to sick leave schemes.[33]

Work-Related Illness and Economic Sector

The likelihood of work-related illness is considerably higher among those working in agriculture, construction, transport and health sectors compared to the combined service sectors that make up the reference group (Model 3). This difference is not accounted for by the age or gender profile of those working in these sectors. In contrast, those working in retail/wholesale or in the accommodation/food sector or in industry are significantly less likely to experience work-related illness than the reference group.

[32] The age squared effect shows that the slope becomes less steep at the top of the distribution.

[33] Highest educational level achieved is not available in the dataset for the modules although it is contained in the main QNHS data.

Most of these differences across economic sectors remain intact when work conditions are controlled (Model 4), with the notable exception that the transport sector no longer has a significantly higher illness rate (than the reference service sectors). This result for transport suggests that it is the prevalence of 'unhealthy' work arrangements (such as long hours, variable hours, shift work or night work) in this sector that account for its higher illness risk.

Model 5 shows that time trends differ somewhat across economic sectors. For ease of interpretation we calculate the recession effect for each sector separately (Table 4.12). The period effect is strongest in the agricultural, construction, transport and health sectors. There is no difference risk of work-related illness in the growth and recession periods for those working in industry, retail or accommodation. As a further check of the business-cycle effect we test the relationship between the annual percentage change in employment within sector and workers' risk of injury. The results of this analysis are presented in Appendix Table A3.5 and show that there is a positive association between employment growth and work-related illness, confirming that the pro-cyclical relationship is the dominant one.

TABLE 4.12 Odds of Illness in Recession versus Boom Period within Sectors and Gender

	Recession period		
	Odds	Sig.	N
Agriculture	.631	.000	12,340
Industry	.888	.171	29,367
Construction	.662	.000	16,390
Retail	.987	.891	27,065
Transport	.669	.001	9,257
Health	.700	.000	22,954
Accommodation	1.145	.350	12,091
Other services	.750	.000	67,971
Men	.695	.000	102,598
Women	.879	.000	95,608

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Results taken from separate sector models and separate models for men and women including all controls in Model 4 above.

Illness and Job Characteristics: Do Some Working Conditions Make Workers Sick?

The final set of factors considered relate to the working conditions and the nature of the employment contract that workers are involved in (Model 4). Holding sector, age and gender constant, the self-employed are no more or less likely to have experienced a work-related illness than employees (though it is still possible that self-employment is associated with the duration of illness absences).

Hours of work are strongly associated with the risk of work-related illness. Those working over 50 hours per week are 1.4 times more likely to have experienced such an illness than those working less than 30 hours per week (with no adjustment made for exposure).[34] Those who work variable hours are also significantly more at risk of work-related illness. As in the case of injury, we examine what happens to illness risk if we calculate full-time equivalent rates as presented in Tables 4.13 and 4.14. Correcting for full-time equivalent hours, we find that those working less than 30 hours are almost twice as likely to experience a work-related illness as those working between 30 and 39 hours a week.

TABLE 4.13 Illness Rates by Usual Hours of Work Uncorrected and Full-Time Equivalent

	Uncorrected %	FTE %	% of Employed
Variable hours	3.7	3.7	10.9
1-9 hours	1.4	7.8	2.2
10-19 hours	2.0	5.0	6.8
20-29 hours	2.3	3.7	12.5
30-39 hours	2.4	2.3	38.0
40-49 hours	2.3	2.0	21.6
Over 50 hours	3.7	2.3	8.0
Total	2.6	2.9	100.0
N	198,644	198,651	198,646

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: All years 2001-2012 pooled. Includes all injuries including those where there was no absence from work.

[34] Note that the association between hours and illness is even stronger if shift work and night work are not included in the model suggesting that there is a correlation between these working conditions.

TABLE 4.14 Regression Model of Illness with and without FTE Corrections

	Uncorrected		FTE	
	Odds	Sig	Odds	Sig
Hour vary	1.131	.022	1.189	.001
1-29 hours	.836	.000	1.981	.000
40-49 hours	1.157	.000	1.041	.318
Over 50 hours	1.151	.016	.759	.000
Constant			.006	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Model also controls for period, gender, age, nationality, sector, hours, self-employment, shift/night work. Results are indicative only.

Both shift work and night work are negatively related to worker's health. Those working shifts or nights are 1.3 times more likely to experience work-related illness. As the odds are multiplicative, those working shifts and nights are 1.7 times more likely to experience a work-related illness than those who are involved in neither work arrangement.

The final working condition addressed is job tenure. Those with shorter job tenure (six months to two years) are significantly less likely to experience a work-related illness than those with job tenure of more than five years. However these estimates do not make any adjustment for exposure. Using the method described above we provide illustrative figures on the relationship between tenure and illness adjusting for exposure (Table 4.15). These figures suggest that making such an adjustment, new recruits with less than six months job tenure have a greater probability of work-related illness than those with over five years tenure. However, those with a job tenure of between six months and two years have a lower probability of illness. The association between illness and tenure may also be affected by access to private health schemes (for example insurance-based schemes within organisations may have qualification periods). The argument that new recruit face a greater risk concerns workplace injury rather than work-related illness. Therefore we do not include a separate model for those with longer term tenures.

TABLE 4.15 Model of Illness (0+days) Adjusted for Exposure Due to Job Tenure (Full-Year Equivalence)

	Odds Ratio	Sig.
Job tenure ref >5yr		
< 6 months	5.69	.000
6-12 months	1.07	.241
13 months-2yrs	.89	.037
3-5yrs	1.03	.403
Constant	.003	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Model also controls for period, gender, age, nationality, sector, hours, self-employment, shift/night work. Results are indicative only.

As noted above, due to changes in occupational classification we examine the association between occupation and work-related illness for the 2010-2012 period only (Table 4.16). We saw in Figure 4.1 above that associate professionals and skilled manuals are most exposed to risk of illness, followed by the categories of Professionals and Operatives while the lowest rates are found for Managerial, Administrative and Sales occupations. Unexpectedly those in elementary occupations experience the lowest illness rate. A formal statistical analysis of occupation and work-related illness as presented in Table 4.16 shows that there is no clear occupational hierarchy for work-related illness. Controlling for sector the occupational groups with the highest odds of illness are the associate professional/technical group and personal service workers. The latter group would be considered part of the working class group in a sociological terms but not the former group. In this model, the strong association between the health sector and illness found earlier is not replicated. This result suggests that it is certain occupations within the health sector that are most exposed. As further data with the new occupational classification become available this can be subjected to further scrutiny.

TABLE 4.16 Model of Work-Related Illness 2010-2012 Including Occupation

	Odds	Sig.
Female	1.55	.000
Age	1.05	.002
Age squared	.99	.004
Non-Irish	1.09	.338
Agriculture	1.16	.311
Industry	.92	.434
Construction	1.44	.006
Retail and wholesale	1.10	.348
Transport	.97	.832
Accomm and food	.82	.184
Health	1.01	.902
Hours vary	1.64	.000
30-39 hours	1.23	.016
40-49 hours	1.14	.190
50 plus hours	1.84	.000
Shift work	1.24	.011
Night work	1.14	.126
Self-employed	1.08	.392
Manager	0.78	.069
Assoc profess/technical	1.27	.016
Administrative	0.82	.078
Sales	0.88	.377
Personal services	1.24	.058
Skilled manual	0.86	.230
Operatives	1.06	.661
Elementary	0.92	.483
Constant	0.01	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Models also control for job tenure.

However, given the interest in the potential impact of insecurity on the mental and physical health of employees, an additional model selecting only employees is run to assess the influence of temporary employment on work-related illness (Table 4.15). The results show that there is no difference between those on permanent or temporary contracts. There is a substantial overlap between short job tenure and non-permanent employment. Across all employees in the sample 36 per cent of those on non-permanent contracts have been in their job for less than six months and a further 21 per cent have a job tenure of between six and

12 months. However, even when tenure is removed from the model, there is no relationship between illness risk and temporary employment. A number of factors may lie behind the absence of a relationship between contract status and illness as found in previous research. First, as noted above, contract may not be a good indicator of security, and feelings of insecurity are widespread amongst permanent employees (Russell et al., 2014). Secondly, given the link between temporary status and short tenure the injury figures for non-permanent employees are likely to suffer from the same under-estimation due to duration of exposure.

TABLE 4.17 Probability of Work-Related Illness among Employees

	Odds Ratio	Sig.
Recession	.840	.000
Female	1.127	.005
Age	1.079	.000
Age squared	.999	.000
Non-Irish	.839	.006
Agriculture	.851	.380
Industry	.826	.001
Construction	.976	.762
Retail and wholesale	.861	.014
Transport	.966	.688
Accommodation and food	.650	.000
Health	1.170	.005
Job Tenure Ref:>5yrs		
Less than 6 months	.949	.508
Tenure 6-12 months	.772	.002
Tenure 1-2 years	.814	.005
Tenure 3-5years	1.013	.788
Hours ref: 1 -29 hours		
Hours vary	1.379	.000
30-39 hours	1.122	.023
40-49 hours	1.148	.022
50 plus hours	1.739	.000
Temporary job	**1.030**	**.690**
Shift work	1.316	.000
Night work	1.232	.000
Constant	.004	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.

Inspection Rate

The relationship between work-related illness and inspection rate is examined in the final model in Table 4.11 (Model 5). The results suggests that net of worker characteristics, job characteristics, sector and period effects, higher rates of workplace inspection are associated with lower levels of work-related illness. Our expectation was that the influence of inspection regime would be primarily seen for workplace injuries because inspections by HSA officers have a strong focus on injury and are more frequently undertaken in economic sectors where there is a higher injury risk (see Chapter 1). However, hazards that expose workers to risks of ill-health are also within the remit of health and safety legislation and inspection. Specific regulations around manual handling, noise and vibration, screen work, pregnant employees, night and shift work and bullying, all have an illness prevention element. Higher inspection rates may therefore be associated with prompting better work practices in these areas. An active inspection regime may also encourage a higher level of compliance with work regulation and employment protection more generally. There is also the possibility that the inspection rates are capturing an unmeasured confounding factor that varies in a similar pattern over time.

4.6 SUMMARY OF RESULTS

The results presented in this chapter highlight the multi-dimensional nature of workplace injury and work-related illness. A wide range of factors are found to combine to produce distinctive risk profiles. Given the multi-factorial influences, statistical modelling is an essential tool in understanding the overall patterns. Holding personal characteristics, job characteristics and sector constant we find that:

- Men are more likely to experience work-related injuries than women.
- Women are significantly more likely to experience work-related illness but only in the period 2008-2012. While we have labelled this a recession effect, future waves of data will establish whether this result is confined to the economic crisis period or signals the emergence of a more persistent gender pattern.
- The likelihood of injury decreased with age while the probability of illness increased marginally. This is consistent with patterns across the general population which show that illnesses increase with age (HSE, 2008).
- Longer hours of work are associated with both a higher probability of work-related injury and ill-health. However making an adjustment for ‘full-time equivalence’ we find that those working a short number of hours per week (less than 30 hours) have a higher risk of illness and injury *per hour worked*.

- Highly variable working hours, to the extent that respondents could not meaningfully record their 'usual hours', are linked to higher injury and illness risks.
- When economic sector and differences in conditions such as hours of work are taking into account, the self-employed do not differ from employees in their risk of non-fatal injury or illness.
- Those working shift patterns and those working at night were more likely to experience both injury and work-related illness.
- The relationship between job tenure and injury risks are complicated by the issue of exposure, however estimating a yearly equivalent injury rate for newer recruits (following Davies and Jones 2005) suggests that accident risks are considerably higher in the first months on the jobs.
- The probabilities of injury and illness reported in the models are multiplicative, therefore workers involved in more than one risky work arrangement or in more than one high risk category will have a much higher chance of experience negative outcomes.

Are The Risks of Injury and Illness Influenced by Macro-Economic Conditions?

- The likelihood of experiencing work-related injuries and illness were significantly lower in recession period (2008-2012) than in the boom period (2001-2007); approximately 22 per cent lower in the case of injuries (Model 3, Table 4.5) and 23 per cent lower in the case of illness (Model 4, Table 4.11).
- The higher probability of injury in the boom period persisted when those with job tenures of less than one year are excluded from the analysis, showing that an increased number of 'new hires' during the growth period cannot fully explain the economic cycle result.
- The fall in injury risk in the recession period was particularly strong in the agricultural sector, the industry sector, and the construction sector. Only in transport and health sectors is the period effect not significant. Employment in the health sector continued to grow through the recession period (see Chapter 1) and therefore this result does not run counter to the pro-cyclical relationship between injuries and growth.
- The boom/bust difference in work-related illness were widest in the agriculture, construction, transport, health and services (education, financial services, public administration), but there was no period effect in retail, industry or the accommodation and food sectors.

- The annual percentage change in employment (by sector) was positively linked to the odds of experiencing injury and illness confirming the pro-cyclical relationship.
- The analysis found that the annual inspection rate was significantly associated with lower levels of work-related injury and ill-health when a wide range of other relevant characteristics were controlled.

Chapter 5

Work-Related Fatal and Non-Fatal Injuries Reported to the HSA

5.1 INTRODUCTION

The 1993 Safety Health and Welfare at Work Regulations require that any accident or illness happening at a place of work involving an employee or a self-employed person, resulting in four or more days of absence, needs to be reported to the Health and Safety Authority. This chapter draws on the HSA data from employers to examine both non-fatal and fatal injuries. The absence criterion means that only more serious injuries are reported and consequently included in the analysis here. As indicated in Chapter 2, the majority of injuries involve less than four days absence. The employer-based reports on non-fatal injuries are also subject to under-reporting, which is quantified in Chapter 1. Nevertheless, these data provide greater detail on the nature of serious injuries in the workplace than is available elsewhere; moreover the fatal injuries are not subject to the same under-reporting issues, though they do exclude road deaths and deaths from work-related diseases (see Chapter 1 and Drummond, 2007a).

The first section of the chapter examines the triggers of occupational injuries across economic sectors and gender for the period 2004-2013. Changes over time in the type of injuries are also examined. Such changes could be due to the structural transformation of economic sectors (level of activities, new production processes etc.) but also related to the impact of policy intervention in terms of prevention and regulation. While the analysis cannot identify the factors prompting change, it can identify where changes have occurred and which groups are most affected. This information may be useful for targeting preventative measures. In the second section, HSA data and Eurostat statistics are used to explore trends in worker fatalities in Ireland and in a European perspective.

5.2 CAUSES OF NON-FATAL INJURIES 2004-2013

The triggers or causes of non-fatal injuries are classified into seven categories as shown in Figure 5.1.[35] We report in Figure 5.1 the number of non-fatal accidents by triggers during the period 2004 and 2013. Across the period as a whole, the largest number of injuries was reported in 2007 (8,149 cases) at the peak of the economic boom, the lowest number was recorded in 2013 (6,384 cases). These figures do not adjust for the numbers in employment (but see Appendix Table A2.1). The most frequent cause of injury was 'manual handling'[36] and 'falls on same level', with the former accounting for between 2,000 and 2,500 cases per year.[37] These represent a third of all non-fatal accidents. Falls on same level are the cause of between 1,100 and 1,500 injuries a year accounting for between 15 and 21 per cent of injuries over the period (Table 5.1). Each of the other triggers identified account for less than 500 injuries in most of the years observed, and account for between 4 and 8 per cent of non-fatal injuries. Over time the structure of triggers has been relatively stable (Table 5.1) though there was an increase in the proportion of injuries due to 'manual handling' between 2004 and 2010. For the same period the largest reduction was for 'aggression, shock, violence' which fell from 8 per cent to 6 per cent. There was a peak in slips, trip and falls 'at the same level' in 2010. Prolonged periods of very cold weather in 2010 may account for this peak.

TABLE 5.1 Trigger of Non-Fatal Injuries (%), 2004-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Body movement no physical stress	6.4	7.4	5.6	5.4	7.2	8.1	5.9	5.7	6.0	6.2
Fall from height	4.0	4.4	4.3	5.6	5.6	5.2	4.4	5.0	4.6	4.8
Fall on same level	16.1	15.1	16.2	17.0	17.4	18.0	20.7	16.8	17.6	17.0
Manual handling	29.4	31.7	34.0	34.0	32.8	31.4	31.2	32.5	33.7	32.6
Loss of control transport or handling equipment	4.9	4.3	4.1	3.8	4.2	3.7	4.0	3.9	3.7	3.6
Aggression, shock, violence	7.8	6.3	4.6	4.8	5.0	5.0	6.1	7.5	6.9	5.6
All others	31.4	30.8	31.1	29.4	27.8	28.6	27.8	28.6	27.5	30.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	7,752	7,794	7,755	8,149	7,895	6,722	7,311	6,848	6,574	6,384

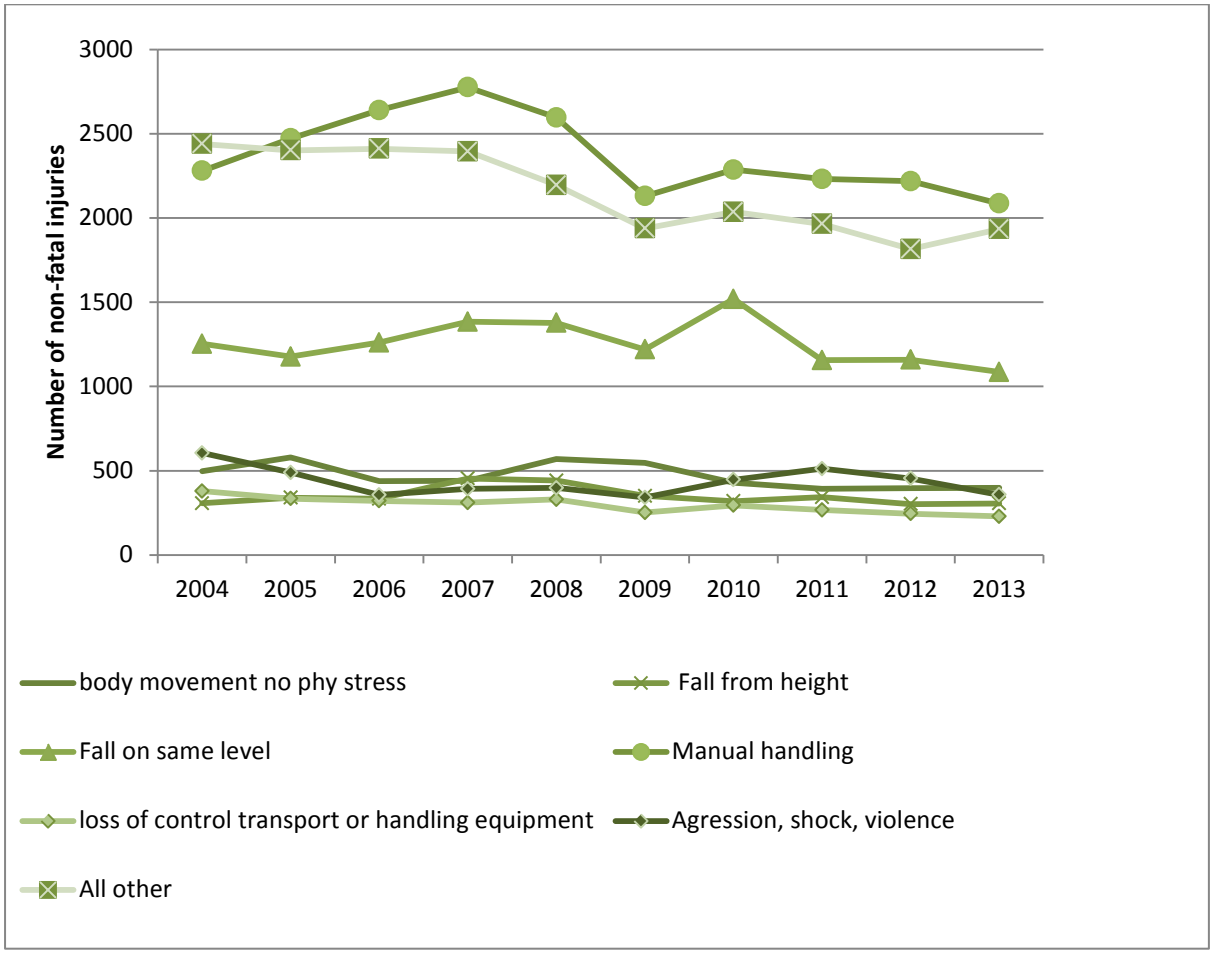
Source: Health and Safety Authority Database, workers only. Authors' analysis.

[35] These categories are constructed using the ESAW methodology. The all other category includes a wide variety of triggers some of which are specific to certain economic sectors; it includes also a small number of cases where the accident trigger is not recorded. See Eurostat (2001) for a detailed list of triggers.

[36] Manual Handling involves any transporting or supporting of any load, and includes lifting, putting down, pushing, pulling, carrying or moving a load.

[37] Falls from the same level are defined as being the results of slips and trips. Note that these figures exclude accidents involving non-workers, a high proportion of these cases involve slips, trips and falls.

FIGURE 5.1 Trends in Triggers of Non-Fatal Injuries, 2004-2013



Source: Health and Safety Authority Database. Authors' analysis.

Injury Triggers by Economic Sectors

It is clear that the triggers of some non-fatal accidents are correlated with the nature of work of some occupations within economic activities (for example 'fall from height' in the construction sector). In Ireland six economic sectors contribute to 80 per cent of all worker's non-fatal injuries reported to the HSA (HSA, 2014, p12) so we focus our analysis on these sectors for ease of presentation and interpretation. The agriculture, forestry and fishing sector represents only 1.3 per cent of all non-fatal injuries in 2013 (*ibid.*, p12) but it had the highest rate of fatal injuries in 2013 (*ibid.*, p15) so we include this sector in the results shown in Table 5.2.

The presentation is also limited to a set of five triggers that represented 85 per cent of all non-fatal injuries in 2013 (*ibid.*, p23). While the trigger 'aggression, shock, violence' represented only 5 per cent of all injuries in 2013 (*ibid.*, p23) it is

included in Table 5.2 because this trigger is highly relevant to the public administration and defence, and health and social work sectors. The distribution of triggers for non-fatal injuries across sectors are presented for three points in time, 2004, 2008 and 2013 and we report any observed significant differences over time for each of these sectors.

For the agricultural sector the main source of triggers is the 'all others' category and the distribution of triggers has been quite stable over time. It is only during the first period from 2004-2008 that we observe a significant difference for the 'fall on same level' with an increase from 10 per cent to 22 per cent during that period.

For the manufacturing sector it is also the 'all others' category that is the main source of triggers and the reduction from 50 per cent to 44 per cent from 2004 to 2008 is significant, as it is also for the overall period. For 'manual handling' and 'fall on same level' there are no significant differences over time.

Many of the triggers in construction also fall into the residual 'all others' category which shrank somewhat from 46 per cent to 42 per cent between 2004 and 2008. On the contrary we observe a small significant increase in the injuries due to 'manual handling' between 2004 and 2008 but no significant difference for the remainder of the period.

For the wholesale and retail sector there are no significant differences in the cause of injuries over time. In the transportation and storage sector, it is also the 'all others'category that is the main source of injuries and we observe only a significant reduction over the period 2004-2013 from 45 per cent to 37 per cent. There was a small but significant increase in 'manual handling' injuries between 2004 and 2008, from 32 per cent to 37 per cent (the increase remains significant for the period 2004-2013).

Public administration and defence and the health sector have several common features. Both sectors experienced a significant increase in the proportion of injuries assigned to the 'all other' category. For the public administration and defence sector there has also been a significant increase in 'manual handling' triggers between 2004 to 2008 (and also between 2004 and 2013) from 17 per cent to 25 per cent, while in the health and social work sector the opposite trend is observed with a significant reduction in manual handling injuries in the second period only from 37 per cent to 30 per cent. Both sectors have also experienced a

significant reduction in the proportion of injuries due to 'aggression, shock and violence' over the period 2004-2013, which fell from 30 per cent to 7 per cent in the public administration and defence sector and from 21 per cent to 16 per cent in the health and social work sector.

TABLE 5.2 Trends in Triggers of Non-Fatal Injuries by Economic Sector (%), 2004, 2008, 2013

	Agriculture	Industry	Construct -ion	Wholesale and Retail	Transport and Storage	Public Admin and Defence	Health and Social Work
			2004				
	%	**%**	**%**	**%**	**%**	**%**	**%**
Aggression, shock, violence	0	1	1	1	4	30	21
Fall from height	3	3	12	3	2	1	1
Fall on same level	10	13	19	18	16	15	17
Manual handling	15	34	23	41	32	17	34
All others	73	50	46	37	45	37	28
Total	100	100	100	100	100	100	100
N	79	1,916	1,339	716	966	858	935
			2008				
Aggression, shock, violence	0	0	0	1	2	**18**	**13**
Fall from height	3	5	11	7	5	3	2
Fall on same level	**22**	14	19	18	16	16	19
Manual handling	15	37	**28**	40	**37**	**24**	37
All others	60	**44**	**42**	33	41	39	29
Total	100	100	100	100	100	100	100
N	97	1,717	1,110	698	992	989	1,093
			2013				
Aggression, shock, violence		0	1	1	2	**7**	**16**
Fall from height	6	5	12	5	6	5	1
Fall on same level	14	14	18	17	16	15	19
Manual handling	16	37	**28**	42	**39**	**23**	**30**
All others	64	**45**	**41**	35	**37**	**49**	**34**
Total	100	100	100	100	100	100	100
N	86	1,046	397	744	798	790	1,409

Source: Health and Safety Authority Database. Authors' analysis.
Note: Bold indicates that the figure is significantly different from the preceding time point or from the starting point i.e. 2004.

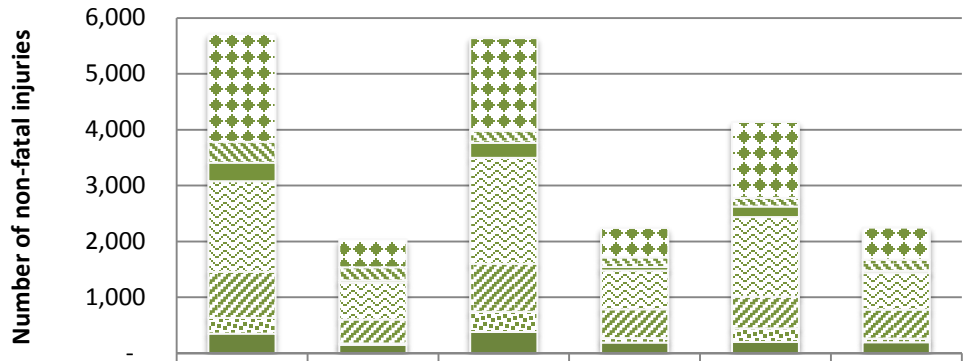
Non-Fatal Injury Triggers by Gender

In Figure 5.2 we present the number of accidents by cause for men and women in the years 2004, 2008 and 2013. For both male and female workers the largest specific cause of accidents is 'manual handling' followed by 'fall on the same

level'. For male workers there was an increase between 2004 and 2008 in the number of accidents due to 'manual handling', 'fall on same level' and 'fall from height' before the number of injuries due to all three of these triggers declined to their lowest levels in 2013.

For women workers the number of accidents due to 'manual handling' has been quite stable over time while the numbers increased for 'fall on same level' and 'fall from height'. Interestingly for men the number of accidents due to 'aggression, shock, violence' was more than halved between 2004 and 2013 while for women the reduction was only of one sixth.

FIGURE 5.2 Triggers of Non-Fatal Injury by Gender (N), 2004, 2008, 2013



	Male	Female	Male	Female	Male	Female
	2004		2008		2013	
All other	1,927	503	1,661	527	1,353	571
Aggression, shock, violence	373	232	217	176	159	197
Loss of control transport or handling equipment	335	41	269	60	187	41
Manual handling	1,619	660	1,892	697	1,427	656
Fall on same level	824	428	860	514	566	518
Fall from height	283	23	363	77	240	64
Body movement no physical stress	347	150	376	190	201	195

Source: Health and Safety Authority Database. Authors' analysis.

The interpretation of the trends above does not take account of the change in the total number of non-fatal injuries that could be due to changes in the numbers employed as well as sectoral shifts. Therefore the change in the relative importance of different injury causes within gender over time is examined (Table 5.3). We note first that across all three years there is a significant difference in the causes of injury between male and females. Focusing on the main source of

accidents for both men and women the percentages of accidents due to 'all others' and 'fall on the same level' remain very stable between 2004 and 2013. There is a significant increase in 'manual handling' causes for men from 28 per cent in 2004 to 35 per cent in 2013 while for women there is a small significant reduction. For all the other categories of accidents there is a general stability in the causes over time for men and women. The small reduction of 'body movement', 'fall from height', 'loss of control' and 'aggression' are statistically significant for men as well as for women in the latter case. So while there has been some large variation in the overall number of non-fatal accidents we find that overall the structure of accident triggers within gender has been quite stable over time.

TABLE 5.3 Triggers of Non-Fatal Injury by Gender (%), 2004, 2008, 2013

	2004		2008		2013	
	Male	Female	Male	Female	Male	Female
	%	%	%	%	%	%
Body movement no physical stress	**6**	**7**	7	9	5	9
Fall from height	5	1	6	3	6	3
Fall on same level	14	21	15	23	14	23
Manual handling	28	32	**34**	**31**	35	29
Loss of control transport or handling equipment	6	2	5	3	5	2
Aggression, shock, violence	7	11	4	8	4	9
All others	34	25	29	24	33	26
Total	100	100	100	100	100	100

Source: Health and Safety Authority Database. Authors' analysis.
Note: Bold indicates that the figure is not significantly different between male and female.

5.3 NATURE OF REPORTED INJURIES

In Table 5.4 we report the type of injuries experienced over time. Back injuries are the most prevalent form of injury, accounting for 23 per cent of injuries on average with very little variation over the period. All the other types of injury represent less than 10 per cent of all cases at the maximum. Overall there was a significant reduction in the proportion of finger, leg and hand injuries and a significant increase in ankle injuries while there are no significant changes for shoulder and arm injuries.

TABLE 5.4 Trends in Body Parts Injuries, 2004-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Back, including spine and vertebra in the back	22.3	24.8	25.2	24.7	23.3	22.3	22.5	22.2	23.8	22.6
Fingers	11.6	12.3	11.3	12.1	11.2	9.2	9.9	9.6	9.5	9.1
Leg, including knee	9.7	8.0	8.0	7.7	8.9	8.0	7.9	7.6	7.2	7.6
Hand	8.7	8.8	7.6	8.9	8.9	7.6	7.6	7.4	6.9	7.7
Ankle	4.1	5.8	6.8	7.2	7.8	6.3	6.4	6.6	6.6	6.1
Shoulder and shoulder joints	6.5	6.1	5.5	5.8	5.1	6.0	5.8	5.7	6.7	6.2
Arm, including elbow	5.2	5.2	5.8	5.5	5.8	6.0	5.7	6.4	6.1	5.6
All others including unknown	31.9	29.0	29.7	28.1	29.0	34.5	34.3	34.5	33.3	35.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	7,515	4,881	4,629	5,314	5,984	6,779	7,331	6,865	6,590	6,396

Source: Health and Safety Authority Database. Authors' analysis.

Injury Type by Gender

There are significant gender differences in the type of injuries received, which is consistent with the differences in the injury triggers noted above and are likely to arise from variation in the jobs occupied by men and women. Women were more likely than men to experience non-specified types of injuries ('all others') as well as arm and shoulder injuries. On the contrary, men are more likely to experience injuries to their fingers, legs and hands. While in 2004 women were more likely than men to experience back injuries, the situation was reversed in 2013.

TABLE 5.5 Types of Injury by Gender (as a percentage of all Non-Fatal Injuries), 2004, 2008, 2013

	2004		2008		2013	
	Male	Female	Male	Female	Male	Female
Back, including spine and vertebra in the back	20.9	23.7	17.4	18.4	23.6	20.8
Fingers	12.3	8.3	9.6	5.8	10.5	6.5
Leg, including knee	10.0	7.9	7.0	6.3	8.0	6.7
Hand	9.0	6.8	7.4	5.1	8.4	6.5
Ankle	4.3	2.8	6.2	5.1	6.1	6.1
Shoulder and shoulder joints	5.6	8.2	3.6	4.5	5.8	6.9
Arm, including elbow	4.8	6.0	3.9	5.6	4.8	7.0
All others including unknown	33.2	36.2	44.9	49.2	32.7	39.4
Total	100.0	100.0	100.0	100.0	100.0	100.0
N	5,708	2,037	5,638	2,241	4,133	2,242

Source: Health and Safety Authority Database. Authors' analysis.

Injury Type and Duration of Absence

One way to evaluate the human and economic impact of injuries in the workplace is to look at the duration of absence from work resulting from the work injury, however it should be acknowledged that duration of absence will also be influenced by institutional arrangements such as sickness/injury benefits and the extent to which the worker can afford to be absent. We present in Table 5.6 the number of days of absence from work and how it changed over three time points: 2004, 2008 and 2013. In 2004, 58 per cent of injured persons were absent for a period of less than two weeks and this was spread evenly between 4-6 days and 7-13 days. This proportion did not change over time and in 2013, 57 per cent were absent for less than two weeks. There was a significant shift, however, in the percentage of workers absent for more than 21 days from 17 per cent in 2004 to 31 per cent in 2013.

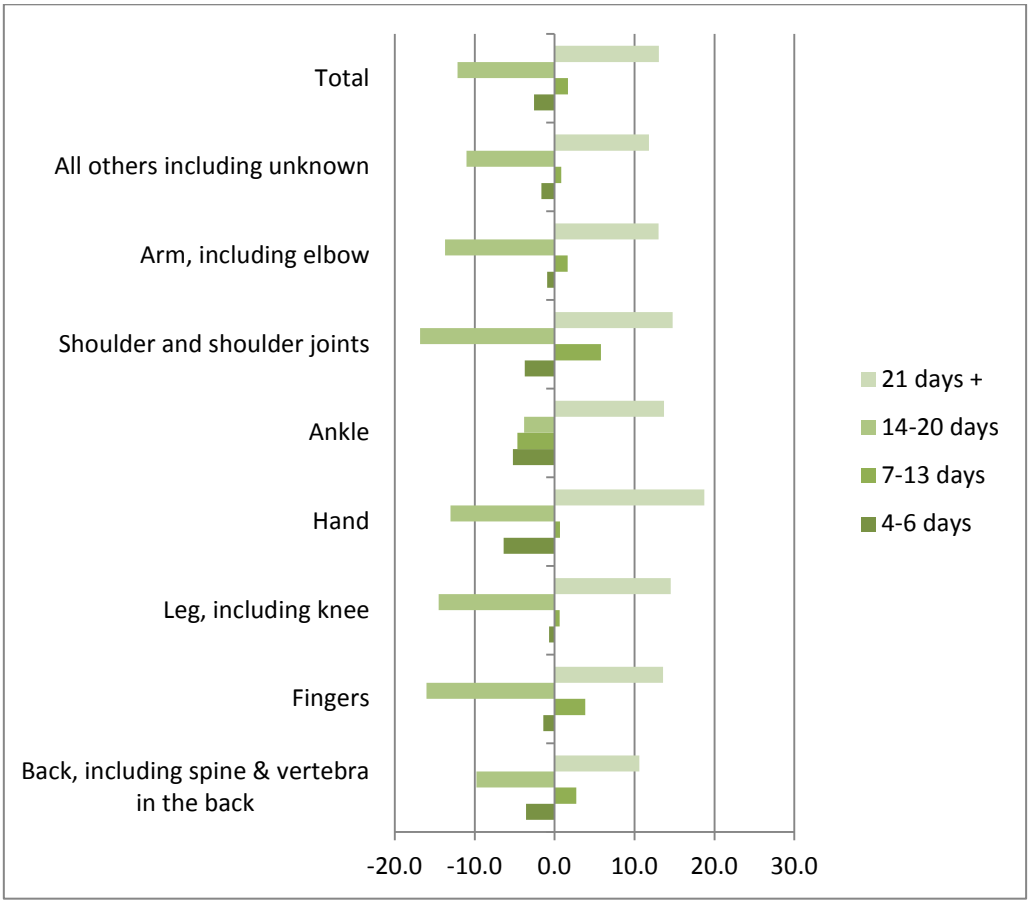
TABLE 5.6 Trends in Duration of Absence, 2004-2013

	4-6 days	7-13 days	14-20 days	21 days +	Total
2004	28.6	29.1	25.0	17.4	100
2008	28.7	29.6	12.8	28.9	100
2013	26.0	30.7	12.8	30.5	100

Source: Health and Safety Authority Database. Authors' analysis.

This rise in the duration of absence does not appear to be related to the nature of the injuries sustained (in a broad sense) as these did not change substantially over the period. In fact in Figure 5.3 we see that between 2004 and 2013 there was a large increase in absences of more than 21 days across the whole range of injuries. Most of the overall increase in absences of more than 21 days took place between 2004 and 2008, which can be seen in Table 5.6

FIGURE 5.3 Difference in the Percentage of Number of Days of Absence From 2004-2013



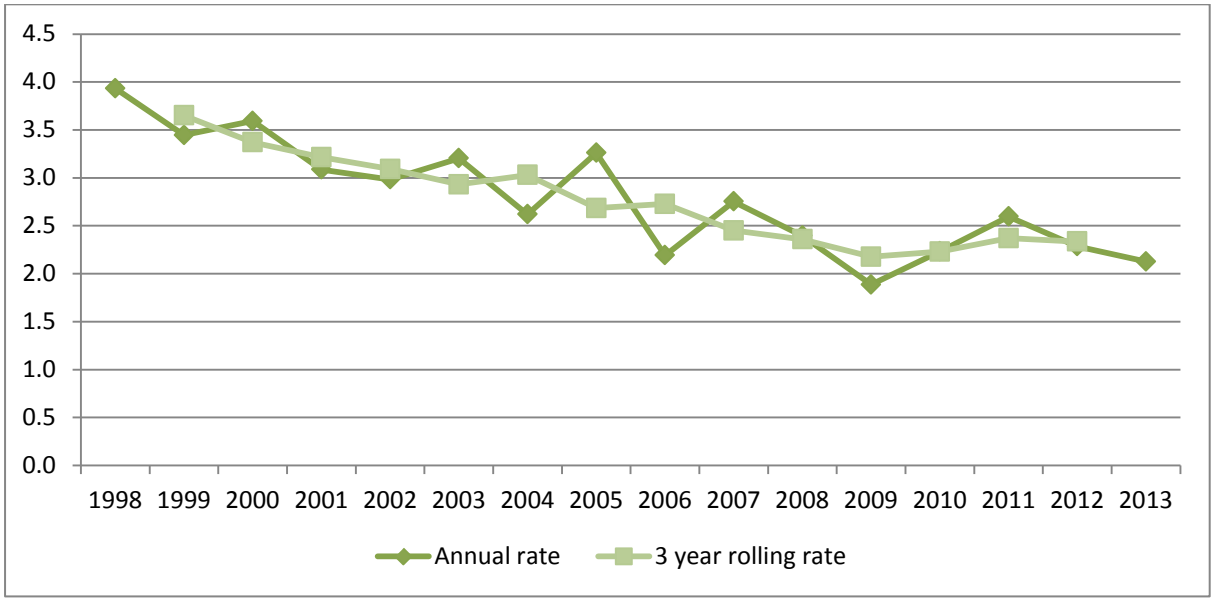
Source: Health and Safety Authority Database. Authors' analysis.

5.4 FATALITIES IN IRELAND

In this section we look the overall trends in fatalities in Ireland for the period 1998 to 2013 as well as by gender and by economic sectors for the most recent period running from 2004 to 2013.

In Figure 5.4 we show the annual fatality rates as well as a three-year rolling rate to obtain a more stable estimate of mortality. Starting in 1998 with almost four fatalities per 100,000 workers, the annual fatality rate had been falling consistently over the period at the exception of a few upward and downward peaks. Over the fifteen years the annual fatality rate has been halved to reach two fatalities per 100,000 workers in 2013. The three-year rolling average followed the same downward trend reaching its lowest level of two fatalities per 100,000 workers in 2009. The rolling fatality rate has remained relatively stable since 2009.

FIGURE 5.4 Rate of Worker Fatalities Per 100,000 Workers, 1998-2013 (HSA)



Source: Health and Safety Authority Database. Authors' analysis.

While in this chapter we are focusing only on workers injuries and workers fatalities, in Figure 5.5 we check whether there are any differences in trends in the number of fatalities between workers and non-workers. The data refer to the more recent period from 2004 to 2013. The results show that the fluctuation in the overall trend is due to the variation in the number of fatalities among workers as the number of fatalities for non-workers is very stable across time.

FIGURE 5.5 Annual Number Worker and Non-Worker Fatalities, 2004-2013 (HSA)

Source: Health and Safety Authority Database. Authors' analysis.

Fatalities by Gender

Chapter 3 showed that while the injury rate (0+ days) of men is 1.5 greater than female injury rate in 2012, the gap has narrowed over time and more particularly in the very recent period since 2010. We present in Figure 5.6 the corresponding rates for fatalities from 2004 to 2012. The risk of fatal accidents is very unequal between male and female. The female fatality rate is extremely low (an average of 0.1 death per 100,00 workers over the period) compared to the male fatality rate of 4.3 per 100,000 workers.

FIGURE 5.6 Fatality Rates by Gender, 2004-2013 (HSA)

Source: Health and Safety Authority Database. Authors' analysis.

Fatalities by Economic Sectors

The 2014 HSA statistical report showed that four economic sectors, agriculture, forestry and fishing, industry, construction and transportation and storage accounted for 90 per cent of all fatalities in 2013. We present in Figure 5.7 the recent fatality rate trends for these four sectors, as well as for the total services sector (excluding the transportation and storage sector) for comparison. The agriculture, forestry and fishing sector has the highest rate of fatalities and excluding the peak years of 2010 to 2012 it varies in the range of 12 and 20. Further detailed numbers show that most of the fatalities are recorded into the agriculture sector.

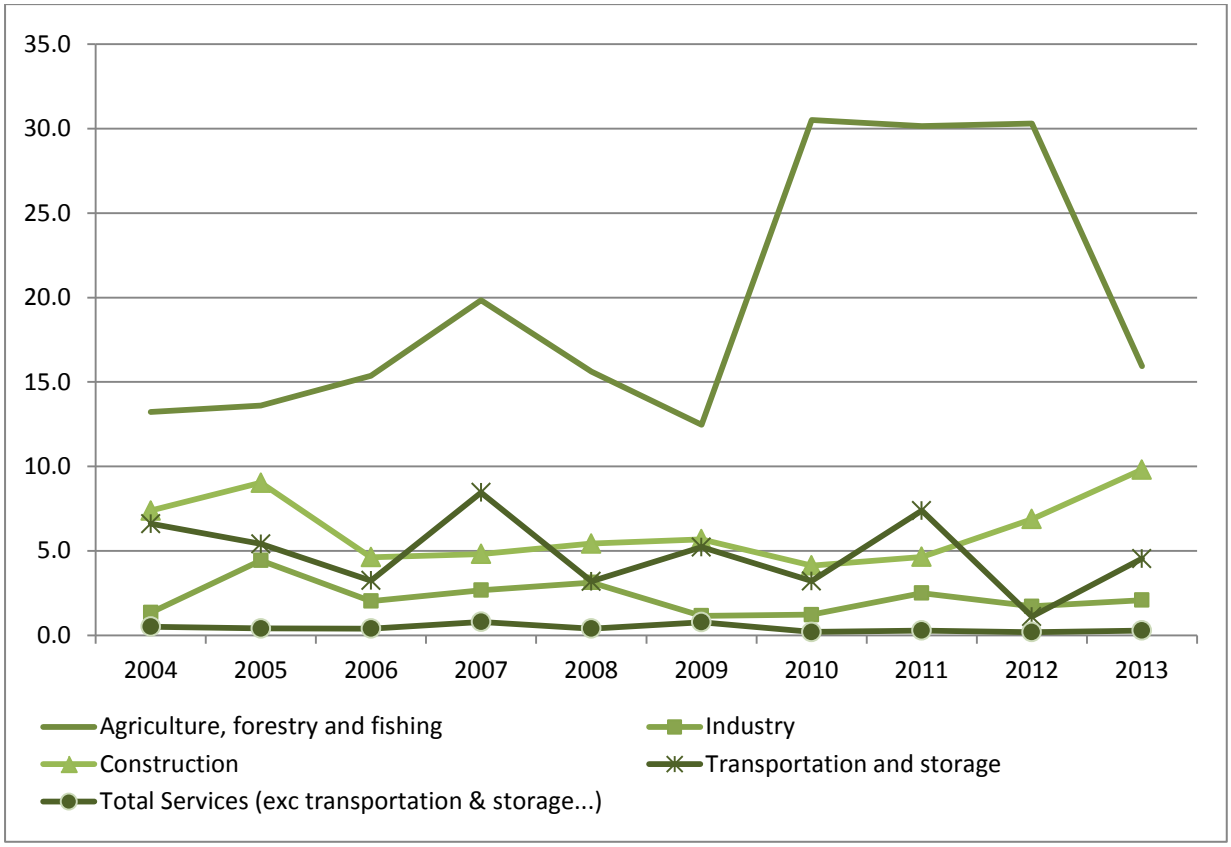
The construction sector has the second highest fatality rate. The fatality rate fell sharply between 2004 and 2010 from 7.4 to 4.1 respectively. From 2010 onwards,

in spite of the severe impact of the economic recession in the construction sector the fatality rate increased steadily to reach its highest level for the overall period at 9.8.

The transportation and storage sector followed a similar trend to the construction sector. The fatality rate fell from 6.6 in 2004 to 3.2 in 2010, and then increased to 4.5 in 2013. With the exception of the low fatality rate of 1.3 in 2004 for the industry sector, the fatality rate fell consistently from 2005 to 2010 with respective values of 4.4 and 1.2. From 2011 onwards the fatality rate for the industry sector increased, rising to 2.1 in 2013.

Finally the fatality rate in the total services sector is extremely low in comparison with the other sectors as it is below 1 for the whole period. We note however, that the fatality rate was on average higher at 0.5 from 2004 to 2009 while it was 0.2 from 2010 to 2013.

FIGURE 5.7 Fatality Rates per 100,000 Workers by Economic Sectors, 2004-2013 (HSA)



Source: Health and Safety Authority Database. Authors' analysis.

Modelling Fatalities Across Economic Sectors

We report in Table 5.7 the results from a grouped logistic regression to test for any overall significant trend over time of workers fatality rates and across economic sectors. The dependant variable is the number of fatalities within economic sector and the explanatory variables are the year and the number of people employed in agriculture, forestry and fishing, industry, construction and other services. The analysis covers the period 2004 to 2013.

In Model 1 we include the 'year' as the only explanatory variable. The odds ratio for the year variable takes a value below 1 indicating a slight negative overall trend in fatalities over the period 2004 to 2013. However this trend is not statistically significant.

In Model 2 we control for economic sector, and the reference group is the service sector. The time trend remains non-significant. The rate for risk of fatal injury for industry is almost three times that of the service sector rate; it is almost eight times higher for the construction sector and 24 times higher for the agriculture sector.

Model 3 tests whether the trends in fatalities over the period differ across economic sectors. The model therefore includes an interaction term between time (year) and the economic sector. The results from the interaction terms show that over the period 2004-2013, fatalities have declined significantly in the service sector (the main year term refers to the services sector) and they have significantly increased in the agriculture sector. There is no significant time trend in fatalities within the industry and construction sectors.

TABLE 5.7 Grouped Logistic Regression of Fatalities (HSA), 2004-2013

	Model 1		Model 2		Model 3	
	Odds	Sig	Odds	Sig	Odds	Sig
Year	0.976	.134	1.006	.726	0.930	.032
Sector ref=service			1.000		1.000	
Agriculture			24.310	.000	11.141	.000
Industry			2.902	.000	2.465	.005
Construction			7.878	.000	5.587	.000
Agriculture*year					1.154	.001
Industry*year					1.029	.614
Construction*year					1.065	.212

Source: Health and Safety Authority Database. Authors' analysis.
Note: Year has been entered as a continuous variable for 2004 to 2013.

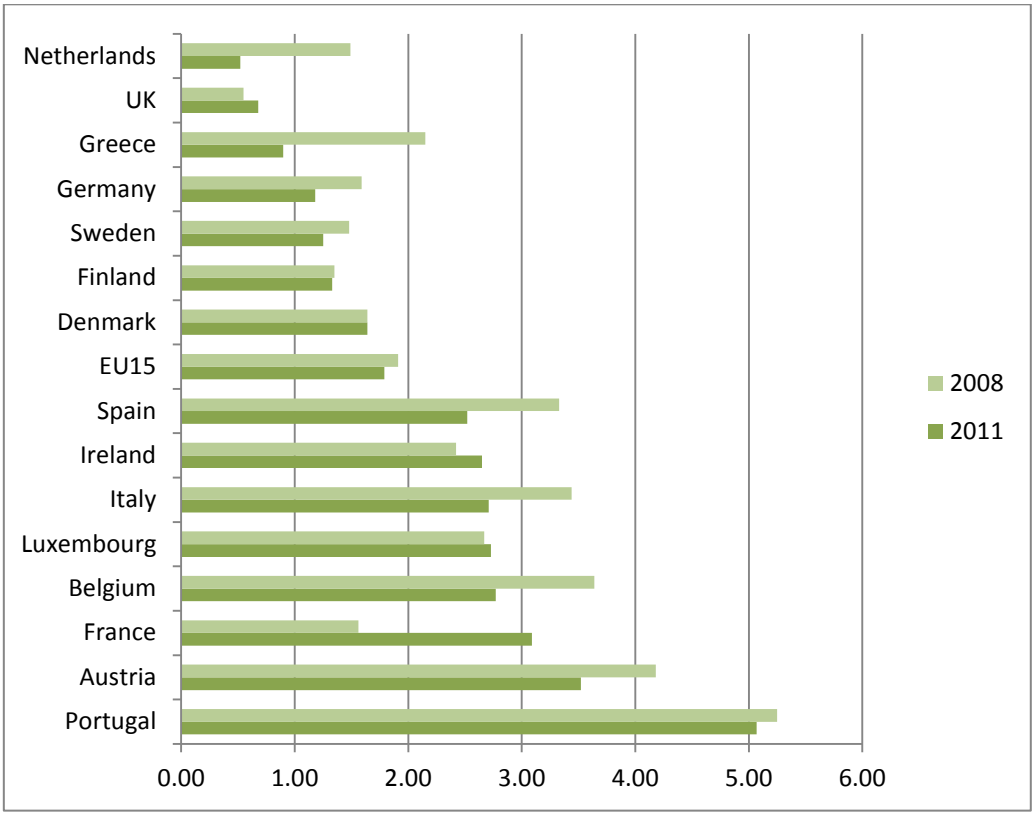
5.5 FATALITIES ACROSS EUROPE

Using European data from the European Statistics on Accidents at Work (ESAW) collected by Eurostat, we compare Ireland's level of fatalities using harmonised fatality rates as well as the trend over time for the period 2008 to 2011, the latest period for which we have relatively large number of EU15 countries. We compare Ireland across a limited set of countries from the EU15. The data compiled by Eurostat come from different data sources across Member States, such as national registers, public insurance/social security schemes and national bodies (such as the HSA) responsible for the collection of data about injuries and fatalities at work.[38] As before, the results presented in this section are for workers only.

We present in Figure 5.8 the harmonised fatality rates sorted by the 2011 values. The fatality rates in 2008 vary between 0.6 in the UK and 5.1 in Portugal. Many North European countries such as Denmark, Sweden, Finland, the Netherlands and the UK have low fatality rates; Ireland is in the middle of the distribution at 2.4. Over time there has been a reduction in the fatality rates between 2008 and 2011 in ten countries. Only four countries have experienced an increase in the rates over the period; France, Luxembourg, Ireland and the UK, but the increase has been overall relatively modest (with the exception of France). With a few exceptions the pattern of distribution across countries is very similar across the two years.

[38] The harmonisation of the data collected is done in accordance with the ESAW methodology distributed to the Member States (Eurostat, 2001). See Brenner and Hopkins (2006) for a discussion about issues on national data comparability on accidents at work across EU Member States.

FIGURE 5.8 Fatality Rates Per 100,000 Workers Across the EU15, 2008, 2011



Source: European Statistics on Accidents at Work (ESAW) tabular data from Eurostat website (http://appsso.eurostat.ec.europa.eu; hsw_n2_02; last updated 26-03-2015).

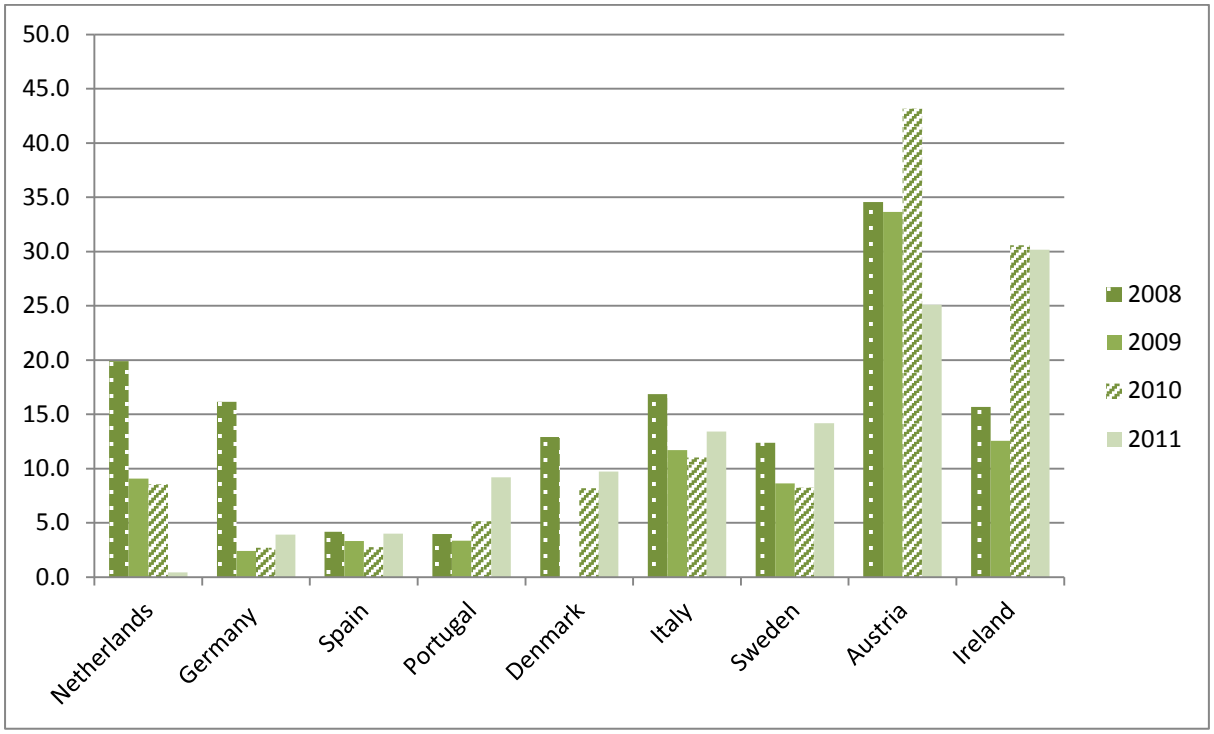
European Trends Across Economic Sectors

Eurostat data of fatalities across countries and economic sectors are available only for a limited set of sectors and for recent years only. We focus here when possible on the sectors that have been described in earlier sections based on the HSA data, and where we have the most comprehensive set of countries.

In Figure 5.9 we present the harmonised fatality rates for the agriculture, forestry and fishing sector across nine countries of the EU15 only as we do not have all the fatality rates for the missing countries. The countries have been sorted by the 2011 rates. There is a very high dispersion of the fatality rates within years across countries as well as across years within countries. In 2008 Ireland was in the middle of the distribution of the fatality rates at 15.7, and while Ireland's rate fell in 2009 at 12.6, most of the countries experienced a greater decrease bringing Ireland to the top of the distribution. In the last two years while most of the countries experienced a further decrease (or stable) of their fatality rate, Ireland's

incidence rates increased dramatically to 30.6 in 2011, the highest values across all the countries shown here.

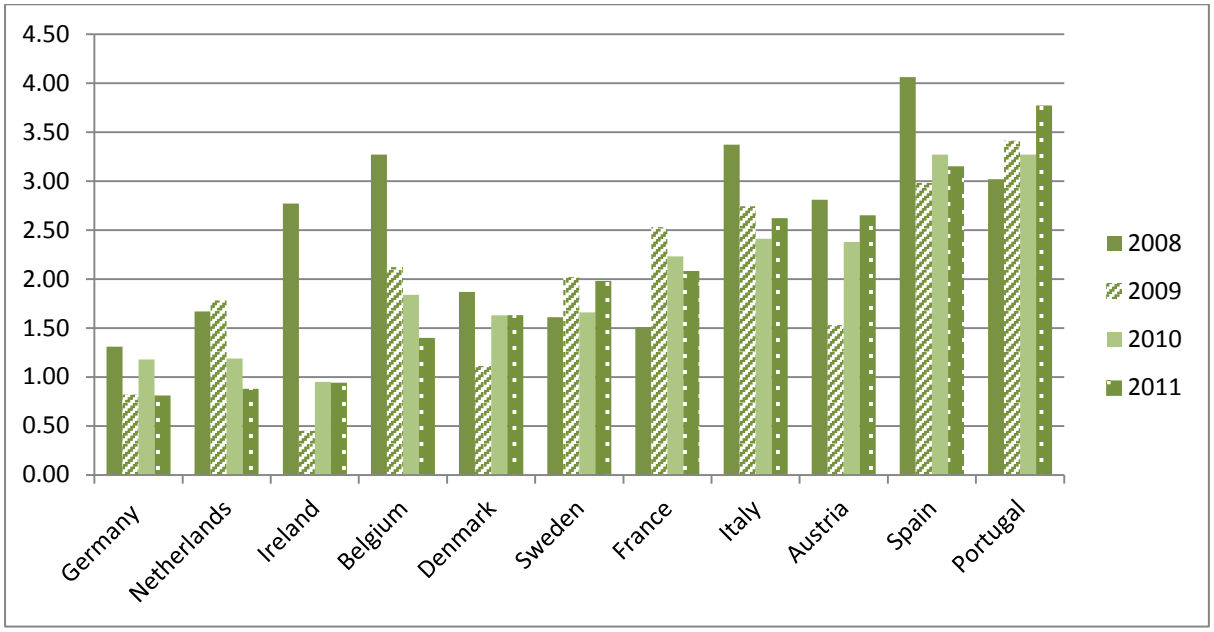
FIGURE 5.9 Fatality Rates Per 100,000 Workers, in Agriculture, Forestry and Fishing Across Nine EU15 Countries, 2008-2011



Source: European Statistics on Accidents at Work (ESAW) tabular data from Eurostat website (http://appsso.eurostat.ec.europa.eu; hsw_n2_02; last updated 26-03-2015).

In Figure 5.10 we present the harmonised fatality rates for the manufacturing sector across nine countries of the EU15 only and the countries have been sorted by the 2011 rates. In 2008 the fatality rates vary between 1.3 in Germany to 4.06 in Spain. The North European countries have the lowest fatality rates while Portugal, Italy and Spain have the highest rates. Belgium and Ireland are more similar to the Southern European countries with high fatality rates. Over time the fatality rates in manufacturing have decreased in the majority of countries with the exception of Sweden (still from a low base), France and Portugal. The largest reduction in the fatality rate occurred in Ireland where the rate fell from 2.77 in 2008 to 0.94 in 2011. With the exception of Austria, all Southern European countries have the highest fatality rates.

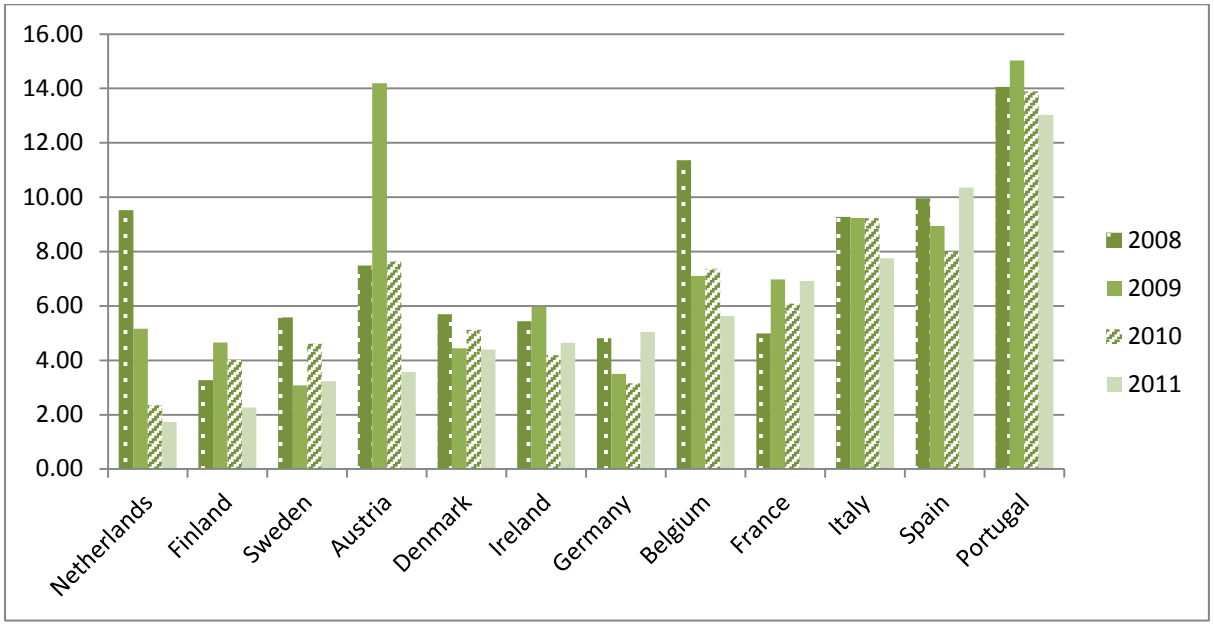
FIGURE 5.10 Fatality Rates Per 100,000 Workers in Manufacturing Across Eleven EU15 Countries, 2008-2011



Source: European Statistics on Accidents at Work (ESAW) tabular data from Eurostat website (http://appsso.eurostat.ec.europa.eu; hsw_n2_02; last updated 26-03-2015).

Figure 5.11 presents the fatality rates for the construction sector for the period 2008 to 2011. The fatality rates in the construction sector are much higher than in the manufacturing sector across all countries, reflecting the universally more hazardous character of many occupations in this sector. However, the levels of fatality rates differ substantially across countries suggesting that institutional factors can make a significant difference in reducing fatality rates. In 2008 the fatality rates in construction ranges from 3.27 in Finland to 14.05 in Portugal. The countries with the lowest rates are in Northern Europe while the Southern European countries have the highest rates. Belgium and the Netherlands also have high fatality rates. Ireland with a fatality rate of 5.43 is located in the middle of the distribution. Most of the countries have experienced a decrease in the fatality rates in construction. In the Netherlands and Belgium the decrease has been extremely large. The fatality rate increased in France; in Spain and Germany there was an increase in 2011. With the exception of the Netherlands and Belgium, the distribution of countries is very similar in 2011 to 2008.

FIGURE 5.11 Fatality Rates Per 100,000 Workers in Construction across Twelve EU15 Countries, 2008-2011



Source: European Statistics on Accidents at Work (ESAW) tabular data from Eurostat website (http://appsso.eurostat.ec.europa.eu; hsw_n2_02; last updated 26-03-2015).

5.6 SUMMARY

In this chapter we draw on data from the HSA to explore trends over time in non-fatal injuries and fatal injuries. For non-fatal injuries between 2004 and 2013 we found that:

- The number of non-fatal injuries peaked in 2007 at the height of the employment boom, while the lowest number was recorded in 2013.
- The causes of accidents were relatively stable between 2004 and 2013.
- The most common cause of injury were manual handling, and slips, trips and falls 'at the same level'.
- Women are more likely to experience 'fall on same level', 'aggression, shock, violence' and men more commonly experience injuries due to 'falls from height' and 'loss of control of transport'.
- The most prevalent and stable form of injury over time is back injuries.
- There was a reduction in the percentage of injured people who were absent for '14 to 20 days' and an increase in the '21+ days' category.

The second section of the chapter looked at work-related fatalities and we found that:

- Fatality rates fell between 1998 and 2013. The fatality rate in 2013 (2 per 100,000 workers) was half that of the 1998 rate (4 per 100,000 workers).
- There is strong gender difference in fatality rates. The fatality rate for women is extremely low and has been very stable over time.
- Across economic sectors there was a significant decline in fatality rates in the service sector since 2001; no significant time trend was observed for fatalities in Construction and industry. However the fatality rates increased in the agriculture, forestry and fishing sector over the period 2001-2013.
- Ireland had the seventh highest worker fatality rate in the EU15 countries in 2011. The fatality rate in the recent period has increased in Ireland while it fell in a selected number of EU15 countries.
- In 2011, Ireland had the highest fatality rate in the agriculture, forestry and fishing sector across nine EU15 countries where data were available. The rates for the other economic sectors were close to the EU average for the countries available.

Chapter 6

Conclusions

6.1 INTRODUCTION

In this chapter we bring together the main findings of the report and consider the implications for policy. The chapter also highlights the remaining gaps in knowledge that require further research and considers the implications of the economic recovery for work-related injury and illness.

Occupational injuries and illness impose significant burdens on individuals, families, employers, the economy and society. Figures for 2011 reveal that 1.8 million working days were lost in Ireland due to work-related incidents and illness; these figures dwarf the number of days lost through industrial action which receive more prominence in the media and public debate (O'Halloran, 2014).[39] Understanding the factors associated with occupational injury and illness is important in terms of prevention and in targeting interventions. This analysis can also help us to anticipate future changes and developments. Understanding the underlying processes and risk factors is particularly important given the rapid changes that have occurred in the Irish labour market over recent decades. Not only has the quantity of work fluctuated considerably, so have the characteristics of the workers who occupy those jobs, who in recent years are more likely to be female and to come from outside Ireland than was the case ever before. The types of jobs that these workers occupy have also shifted over time. In Chapter 1 we highlighted the substantial changes in the sectoral composition of employment which encompass both economic cycle effects and also longer-term structural shifts from agriculture and manufacturing to services. Patterns of working time have also undergone significant change with a rise in part-time work, and a decline in long working hours. While the trends in occupational injury and illness are regularly monitored (HSA annual statistics reports) the implications of these changes for the health and safety of workers in Ireland has received little systematic attention.

[39] The median number of days lost through industrial action over the period 2001 – 2012 was 14,635 (calculated from CSO, QNHS figures).

6.2 TRENDS OVER TIME, FROM BOOM TO RECESSION

A body of international research has investigated the link between the economic cycle and workplace injury and illness (see Chapter 1) and the dramatic changes experienced in Ireland provide a useful test case for examining the alternative propositions in this literature. In our analysis we compare the odds of experiencing occupational injuries and illness in a recessionary period (2008-2012) with a period of exceptional growth (2001-2007). Holding a wide range of other relevant factors constant, the recession period in Ireland was associated with a significantly lower probability of occupational injury and illness than the boom period. We tested the argument that this association was due to the higher proportion of inexperienced new recruits in periods of economic growth. However, even when those with job tenures of less than a year were excluded from the analysis, we found that the likelihood of experiencing an accident remained higher in the boom period. Alternative explanations have suggested that longer hours of work and increased work intensity during periods of high demand create greater risks of workplace accidents (Green, 2001; Davies and Jones, 2005). The period effect cannot be accounted for by hours of work, which are controlled in the model, but the QNHS data do not contain measures of work intensity or job pressure. We also found that the annual percentage change in employment in the respondents' industry was positively associated with both injury and illness, i.e. an increase in the numbers employed was associated with a rise in the risk of injury and illness. This strengthens the conclusion of a pro-cyclical trend for both injury and illness.

A further explanation for business-cycle effects centres on the behavioural responses of employees; it suggests that in a recessionary period, workers will be reluctant to admit to any workplace accidents or to take time off for illness because of job insecurity (Boone et al., 2011; Livanos and Zangelidis, 2013). While the data analysed in this study are gathered from a household survey rather than from employer reports and include cases involving no absence from work, it is still possible that incidents that were not acknowledged at the time or did not involve an absence may be less likely to be recalled (although it should be noted that a significant proportion of respondents recorded injuries and illnesses where there was no absence from work).

The economic cycle results may also be affected by the 'healthy worker effect' whereby those with health problems are more likely to exit employment or are less likely to be recruited. These processes are likely to be intensified during a recession when there are a very high number of candidates for every vacancy and where older workers may be incentivised to take early retirement, or redundancies are targeted on workers who are seen as 'less productive'. While

discrimination on the basis of age and disability are banned under equality legislation these practices still exist in the labour market (Bond et al., 2010).

An alternative explanation is that working hours, work intensity and pressure are higher during boom periods, which increases risks of injury and illness through tiredness, working at speed, cutting corners to complete tasks and higher stress. Hours worked per week were included in the model and did not account for the period effects; however, pressure and work intensity were not measured in the QNHS. Moreover the relationship between work demands and stress is mediated by workers' level of control or autonomy, high demands combined with low control leading to the highest stress levels (Eurofound 2013; Karasek, 1979; Karasek and Theorell, 1990). Therefore examining the underlying mechanisms would require much more detailed data on job conditions.

Differences in the strength of the period effect by sector suggest that responses to fluctuations in demand may vary across sectors. Longitudinal information would be necessary to disentangle these effects and to assess the extent to which differentials in recruitment and redundancy/job loss play a role. Occupational differences across the boom and bust periods could not be investigated for Ireland due to changing occupational classifications and it is possible that boom effects also differed by occupation.

In the case of work-related illness, the pro-cyclical effect was again dominant. However, no boom versus recession period effect was found in retail, accommodation and food and industry sectors This result for retail and accommodation/food is likely to be related to the finding of a much weaker period effect for female workers: for women the odds of illness were 12 per cent lower in the recession period while for men the odds were 30 per cent lower. This gender pattern may be connected to gender difference in the recession impact – whereas men were more likely to lose their jobs women were more likely to have experienced a deterioration in certain aspects of job quality such as an increase in job pressure (see Russell et al., 2014).

While the odds of injury changed over the period and the number of injuries reported to the HSA declined, the distribution and relative importance of causes of injuries reported to the HSA (involving absences of over three days) remained almost the same through the period 2004-2013. The main causes of injuries were 'manual handling' and 'falls on same level'. Because the 'all other' category is large it may disguise some changes in the less common injury triggers. Men and women differ in their sources of injury, with a higher percentage of 'manual

handling' accidents for men than women and a higher percentage of 'falls on the same level' for women. Women are more likely to experience 'aggression, shock, violence' than men, particularly in the health and social work sectors. These findings suggest that there is room for improvement in preventing such accidents and incidents. The HSA data also showed a substantial increase in the percentage of injuries involving more than 21 days absence from work. Between 2004 and 2008 the percentage rose from 10 per cent to 19 per cent and reached 21 per cent in 2013. These suggest that there has been an increase in the long-term negative impact of accidents for the injured persons as well as for the employer and the economy (in terms of cost to social welfare and lost productivity). Investigating the source of this increase was outside the scope of the current research study but warrants further investigation. What our analysis did show was that the increase was not due to a change in the type of injury suffered as the rise in long absences was observed across all broad injury types.

Comparing work-related fatality rates in Ireland to those elsewhere in Europe we find that within the EU15, Ireland had already a relatively high fatality rate in 2008. However, unlike most of the other countries, Ireland's fatality rate increased between 2008 and 2011 keeping Ireland in the top of the fatality rates table in 2011. This is due to the large increase in the number of fatalities in the agricultural sector in the years 2010 and 2011 when fatalities in this sector accounted for more than 50 per cent of all fatalities. A focus on this sector seems to be particularly relevant to reduce the overall fatality rates. Establishing whether fatal accidents were due to 'risks taken' or to lack of experience/training in the use of machinery or hazardous conditions would require more qualitative investigation. In both cases training, education and preventive measures and inspection/enforcement may be appropriate for reducing these rates.

6.3 WHO IS MOST AT RISK OF OCCUPATIONAL INJURY AND ILLNESS?

The analysis also highlighted the role of personal characteristics in the structuring of occupational injuries and ill-health. Men are significantly more likely to experience work-related injuries than women even when a wide variety of relevant working conditions and sector are controlled, including occupation in the most recent years. Further analysis focusing on occupations within sectors would be necessary to establish whether this explains the patterns observed or whether there are gender differences in risk-taking behaviours that affect the outcomes.

The odds of injury decreased with age while the odds of work-related illness increased. This latter finding is consistent with the positive association between age and ill-health in general. The 'healthy worker effect' whereby those with the

poorest health withdraw from the labour market is likely to mean that the strength of relationship between age and work-related ill-health is under-estimated. Lower injury risks for older workers may be due to greater job experience, lower risk taking and to a selective reduction in involvement in heavy manual tasks.

Our reading of the literature led to an expectation that migrant workers would have a higher rate of work-related illness/injury. However, non-Irish workers were less likely to experience work-related injury or illness. We speculate that this may arise because of the heterogeneous composition of this group of workers which includes those from both inside and outside the EU, non-English speakers, highly qualified workers and the unskilled. When we control for occupation, in the most recent years of the study (2010-2012) we find the effect of nationality becomes non-significant. Other explanations for lower rates of injury and work-related illness among migrants include lack of knowledge of employment rights (see Russell et al., 2014), and consequent reluctance to report injuries or take sick leave, as well as under-representation of the most vulnerable migrants in the QNHS survey.

6.4 WHICH ECONOMIC SECTORS HAVE THE GREATEST RISK OF INJURY AND ILLNESS?

The risk of work-related injuries is persistently higher in construction, Farming/ forestry/fishing, health, the accommodation and food sector, and industry. These differences persist even when factors such as the age profile of workers in the sector, and work practices such as long hours, shift/night work are taken into account. The analysis also shows that workers in the agricultural, construction and industry sectors are most at risk of fatal injuries. These results suggest that there is a continued need to target these sectors in terms of injury prevention. The factors that trigger injury also vary across sector; for example, aggression, shock and violence feature much more strongly in the health sector and in the public administration and defence sector, while injuries caused by manual handling are more common in the retail/wholesale, industry and health sectors. A high proportion of farming, forestry and fishing accidents fall into the 'all other' triggers category, suggesting that there is greater variability in the causes of accidents in this sector and therefore prevention needs to be multi-factorial. The relative stability of the causes of accidents in many sectors between 2004 and 2013 suggests that such injuries are foreseeable and preventable.

Turning to occupational illness, we find that the risk is significantly greater in the agriculture, construction, transport and health sectors than in the combined

service sector (excluding health, retail and accommodation and food services). These differences are not due to the gender or age profile of the workers in these sectors. However, the higher risk of illness in the transport sector is found to be due to the prevalence of demanding work arrangements such as shift work and long hours. Analysis of the types of illness across sectors was outside the scope of the current study but is an important issue for future research and policy development.

6.5 WHAT JOB CHARACTERISTICS INCREASE THE RISK OF INJURY AND ILLNESS?

The study clearly identifies a number of working conditions and arrangements that have a negative impact on worker's health and risk of injury. Longer hours of work are associated with a higher probability of both injury and ill-health. Highly variable working hours were also linked to higher injury and illness risks. This result is important in the light of the emergence of zero-hours contracts, and the more permeable boundaries between working time and leisure/family time due to technological change. However, the overall decline in work hours noted in Chapter 1 should have a positive impact on injury and illness rates. The figures on working hours are not adjusted for exposure so it should be noted that some of the increased risks with longer hours may be attributed to higher exposures over the working week.

Long hours and variable work hours are both more common among self-employed workers, but when these conditions as well as economic sector are taken into account, the self-employed do not differ from employees in their risk of non-fatal injury or illness. Nevertheless, they may well be a target group for addressing the hazards associated with working time arrangements.

The self-employed were also considerably over-represented in the fatal injury statistics. This is connected to their location in higher risk sectors such as agriculture and construction, but their risk of fatal injury may also be exacerbated by long working hours and the attendant problems of fatigue and concentration lapse. Working alone may also be a risk factor for the self-employed but this could not be evaluated with the available data.

The scheduling as well as the quantity of work hours is important. Those working shift patterns and those working at night were more likely to experience both injury and illness, controlling for a wide range of other job and sector characteristics. While shift arrangements and night working may be required for the smooth running of essential services, the findings suggest that those involved

in such work patterns should be compensated for the additional costs involved. This includes an elevated risk of injury and ill-health. The receipt of differential rewards for higher risk jobs was outside the scope of the current study but is a topic that has received some attention in the economic literature.[40]

The relationship between job tenure and injury risks is complicated by the issue of exposure. Following the method used by Davies and Jones (2005) we estimated a yearly equivalent injury rate. This adjusted rate of injury for those with a job tenure of one month or less was 16.8 per cent compared to a rate of 2.4 per cent for those who had a tenure of over five years. Controlling for other factors, those with tenures of less than six months were 4.2 times more likely to have experienced a workplace injury than those with a tenure of over five years. The probability of work-related illness is less closely tied to job tenure though there is some indication that those in jobs of less than six months are more likely to have experienced an illness than those with longer tenures when an adjustment is made for exposure.

6.6 INSPECTION RATE

The models of injury and illness also tested the effect of the rate of inspections per 1,000 workers carried out each year. This is a relatively crude indicator of the level of state intervention in preventing injury/illness and in enforcing protective legislation. Nevertheless, the analysis found that the annual inspection rate was significantly associated with lower levels of work-related injury and ill-health when a wide range of other relevant characteristics were controlled. There was also suggestive evidence that the inspection regime has a stronger positive influence in the case of new recruits. The discussion in Chapter 1 highlighted that inspection rates per 1,000 have fallen since 2009 and are now back below 2005 levels.

6.7 IMPLICATIONS FOR POLICY

The study has identified a set of risks for work-related injury and illness which may be useful as a guide for targeting either groups at risk, or preventative measures that ameliorate these risks. The responsibility for reducing work-related injuries and illness lies with both employers and the State in its role of regulating employment standards and promoting public health (through education and other means). The State's regulatory role includes monitoring compliance with health and safety legislation and prosecuting those who fail to adhere to it. Employers' responsibilities include, but are not limited to, providing

[40] This is a central prediction of competitive wage theory (see Smith 1979, Dorsey and Walzer, 1983).

a safe and healthy work environment and working conditions for employees, and the provision of adequate training of workers. International evidence suggests that preventing work-related injury and ill-health is more cost effective than dealing with the consequences when they occur (OSHA 2012). The current research does not investigate what balance of actions between employers and the State would most effectively enhance worker health and safety; however, it is likely that a co-operative approach between the main actors, including employees, will be needed.

High risk sectors for injury, such as agriculture, construction and the health sector were already well known; however the current analysis highlights some of the underlying factors that are associated with these risks. For example working hours arrangements and tenure account for a part of the sector differences (except in the case of construction and retail). Sector differences in illness are weaker but still significant, with construction, transport and health showing a higher likelihood of illness; in the case of the transport sector this was linked to high levels of night and shift work. Significantly lower illness risks were noted in the retail, accommodation and food and industry sectors but these three sectors did not experience the decline in work-related illness in the 2008 and 2012 period that was experienced in all other sectors. This may highlight a need for focusing policy attention in this direction.

Those with short job tenures have a particularly high risk of injury, when their shorter exposure is taken into account. This suggests that investment in the training and mentoring of new recruits is a useful strategy to reduce the risk of workplace injuries. This issue will become increasingly important as the Irish economy recovers and recruitment increases.

Education on the injury and illness risks associated with variable work hours, shift hours and working nights may also be important in informing employers and employees about the benefits and costs of different working arrangements. This is also true for the self-employed. The negative relationship between variable hours and worker health and safety points to an additional reason for concern with the increase in zero-hours or minimum hours contracts. The policy implications for total working hours is not clear: the models suggest that long working hours (over 50 hours per week) is a risk factor for injury and illness; however, when we calculate a full-time equivalent injury and illness rate the reverse is found, i.e. those working less than 30 hours per week are at greater risk per hour worked. The evidence from other studies on the effect of long working weeks is also mixed and many previous studies do not adjust for hours of

exposure (see Chapter 4). Further information on the numbers of hours worked per day, or on the day of the injury could provide further insight into these risks.

The severe under-reporting of injuries among the self-employed to the HSA suggests a need to enhance efforts to engage with this group, especially in the light of the high number of fatalities among self-employed workers. Action to increase the reporting of self-employed workers and to improve protection for this group could include measures to increase the coverage of the self-employed in the social insurance system including benefits related to work-related illness and injury (Advisory Group on Tax and Social Welfare, 2013).

Research in other areas of the labour market has identified the 'scarring' effects of recession. For example, it has been found that the effects of unemployment in the early career can have long-term consequences for occupational attainment, while the effects of unemployment on psychological wellbeing have been found to persist up to 20 years later (Bell and Blanchflower, 2011, Clarke et al., 2001). This means that the impact of the recession may be felt in the longer term. In the case of occupational injury and ill-health it may be that the stresses of insecurity will influence longer-term mental health. Moreover, the effects of serious injury, whether they occur during time of boom or bust, may have long-term economic and health consequences for those affected.

The figures on inspection rates suggest that enforcement of health and safety legislation in this manner can improve the injury and illness rates in Irish workplaces. However the number of inspections per 1,000 workers is now in decline. Moreover, when ratio of the numbers of workers to the number of inspectors is compared across countries, Ireland has one of the worst ratios, with just under 19,000 employees per inspector. Only Belgium and the Netherlands report a higher ratio but a greater population density might mitigate the negative impact in these countries. The overall level of State support for enforcement and prevention of occupational injury and ill-health has also fallen, as a consequence of very significant cuts in public expenditure across all policy areas to deal with the fiscal crisis. While this study has not undertaken an analysis of the costs and benefits of different interventions, the findings suggest that further falls in the inspection rate could have negative consequences for workers.

The QNHS modules provide a robust source of data on work-related injury and illness, however, the purpose of the survey is not to collect detailed information on work tasks, work environment and working conditions. It would therefore be extremely useful to conduct a new round of the National Workplace Surveys (of

employers and employees) previously fielded in 2003 and 2009, including questions relating to health and safety at work alongside the detailed questions on working conditions already included in the questionnaire.

6.8 IMPLICATIONS OF FUTURE CHANGES IN EMPLOYMENT

The most recent labour market figures suggest that in the year to the first quarter of 2014 there was an increase in employment of 42,700 (CSO, 2014). The sectors showing most employment growth included those with traditionally high occupational injury levels such as agriculture, forestry and fishing, construction, accommodation and food. Employment also grew in sectors with lower risks including Professional, Scientific and Technical activities and Administrative Services. However, the CSO note that caution should be exercised in interpreting these sector level trends, particularly for agriculture, due to sample changes in the QNHS.

The trends in the composition of the workforce outlined in Chapter 1 also have implications for the future. The Irish workforce is predicted to age significantly over the next decades (CSO, 2013). In the light of the evidence presented here, this trend is likely to have a positive influence on the injury rate but is likely to increase the rate of work-related illness.

The growing feminisation of the workforce is also likely to have implications for the future. Women are found to have significantly lower odds of injury than men controlling for a wide range of other job and personal characteristics. However, the period since 2008 has seen the emergence of a gender difference in work-related illness whereby women were more likely to experience such illness holding a range of other factors constant. Should this trend continue, greater female employment may lead to an increase in the illness rate.

The long-term decline in working hours is likely to have a positive impact on work-related health and injury, but emerging trends on variable work hours and zero hours contracts may undermine these positive changes.

6.9 ISSUES FOR FUTURE RESEARCH.

In the case of all three personal characteristics examined, gender, age, and nationality, further research is warranted to explore the occupational, organisational and behavioural factors that may lie behind these group

patterns.[41] In the case of age differences longitudinal research which could identify occupational and sectoral mobility patterns among older workers would also contribute to knowledge of the mechanisms involved. This would also provide a solution to the 'healthy worker' bias whereby those who may have been most impacted by illness or injury have left the labour market. The Irish Longitudinal Study on Ageing (TILDA), a longitudinal study of older people in Ireland, provides data that may be suitable for this purpose.

Further research that disaggregates the effect of inspection rates within industries may also highlight areas where intervention of this sort has been more or less effective. Additional analysis of the duration of absence in the case of illness and injury is also warranted, though this would best estimated by including information on the sick leave entitlements of individual workers.

The relationship between occupational injuries/illness, disability and employment is also an issue that would benefit from further research. We know from other research that most disability among working age adults is acquired during adulthood rather than being present from childhood. Among working-age adults with a disability, seventy per cent acquired the disability after their school years and just over 40 per cent left work because of their disability (Watson, Banks and Lyons, forthcoming). While not all disability affecting working age adults will be the result of workplace accidents or work-related illness, an important challenge in terms of the health and safety of the workforce is to investigate ways in which workers who do become ill or injured can be enabled to continue in employment.

Comparative analysis on Ireland's position relative to other European countries could shed light on distribution of different risks and hazards in Ireland compared to elsewhere. It could also examine whether the groups at risk and the consequences of work-related injury and illness differ across countries. Policy learning (rather than policy transfer) from other countries can highlight effective strategies for reducing the incidence of work-place injury and illness and the burden these place on workers, employers and the wider society.

[41] The occupational coding changed over the data period so that it could not be included in the analysis. Exploratory analysis on individual years suggested that the sector effects dominated occupational effects. Moreover, some of the occupational differences are captured by the job characteristics.

Appendix 1

Comparisons of Alternative Sources of Data on Occupational Injuries and Illness

TABLE A1.1 HSA Injury Reports (4+ days) and QNHS Injury Estimates (4+days) by Employment Status

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Self-Employed[1]									
A. HSA reports	71	119	86	88	83	78	51	43	40
B. QNHS estimate	5,224	3,902	4,880	5,212	4,975	1,907	3,784	2,675	3,843
A/B (%)	1%	3%	2%	2%	2%	4%	1%	2%	1%
Employees									
A. HSA Estimate	7,448	7,567	7,581	8,005	7,779	6,692	7,271	6,814	6,541
B. QNHS estimate	16,808	19,938	19,512	23,580	12,923	9,547	15,691	14,169	13,944
A/B (%)	44%	38%	39%	34%	60%	70%	46%	48%	47%

Source: Health and Safety Authority Database and QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: HSA figures only include workers. Yearly fluctuations may arise from both data sources.
[1] denotes self-employed and relatives assisting

TABLE A1.2 HSA Injury Reports (4+days) as a Proportion of QNHS Injury Estimates (4+days) by NACE

	2004	2005	2006	2007	2008	2009	2010	2011	2012
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Agriculture	4	6	9	7	5	26	9	18	6
Manufacturing	57	45	40	29	102	148	85	42	53
Construction	23	25	28	27	34	89	21	18	24
Wholesale and Retail	37	28	56	19	30	23	23	56	40
Transportation and Storage	46	107	25	61	74	52	53	62	74
Accommodation and Food	14	9	34	10	25	35	15	20	16
Public Admin and Defence	72	45	58	119	94	120	34	55	79
Education	24	12	22	10	39	30	22	7	45
Health and Social Work	33	35	22	44	50	59	71	85	34
Other services	53	64	35	15	24	47	30	51	24

Source: Health and Safety Authority Database and QNHS Annual Modules on Work-Related Accidents and Illness. Authors' analysis.
Note: Figures of over 100 per cent signify that more cases were reported to the HSA than were estimated in the QNHS module.

The comparison of HSA reports and QNHS estimates of the numbers experiencing an injury requiring four or more days absence from work show that:

- Only 1-4 per cent of the self-employed injuries estimated in the QNHS appear in the HSA statistics.
- The highest rates of reporting to the HSA occur within public administration, the health sector and industry.
- The rate of reporting to the HSA is very low in agriculture and in the accommodation/food industry.
- The number of four-day-plus injuries recorded in the QNHS in 2009 is exceptionally low. These figures suggest that there was a significant under-estimation of injuries in manufacturing and public administration/defence in the QNHS module that year.

TABLE A1.3 Occupational Injury Benefit Claims (DSP)

Year	Claims Allowed	Days Lost*	Avg. Days Lost per Claim	N Employed 000s	Claims per 1000 Employed
2000	11,995	N/A	N/A	1697.65	7.1
2001	12,050	N/A	N/A	1,749.6	6.9
2002	12,280	N/A	N/A	1,776.5	6.9
2003	11,096	N/A	N/A	1,810.1	6.1
2004	11,705	N/A	N/A	1,871.1	6.3
2005	11,759	N/A	N/A	1,962.8	6.0
2006	12,416	N/A	N/A	2,053.6	6.0
2007	13,803	502,178	36	2,143.1	6.4
2008	13,017	494,866	38	2,128.4	6.1
2009	13,099	489,308	38	1,961.4	6.7
2010	11,813	423,394	36	1,882.2	6.3
2011	11,616	406,730	35	1,849.1	6.3
2012	10,972	392,436	36	1,851.4	5.9
2013	11,428	414,997	37	1,881.2	6.1

Source: Department of Social Protection figures reported in HSA (2014a).
Note: The number of days lost refers to the number of paid claim days and therefore does not count the first three days of the claim or Sundays. Including these unpaid days leads to a figure of 537,862 days lost in 2013 and an average of 47 days per claim.
N/A: not applicable.

TABLE A1.4 Principle Economic Status Among those of Working Age % (18-64 years) QNHS

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Employed	67.8	68.9	69.8	70.4	69.3	63.7	61.5	61.1	60.2	61.7
Unemployed	4.2	4.2	4.2	4.2	5.0	10.7	12.1	12.5	12.9	11.4
Student	7.5	7.3	7.1	6.9	7.1	7.2	7.8	8.0	8.1	8.6
Home duties	14.5	13.6	12.9	12.4	12.3	12.1	12.2	11.9	11.8	11.4
Retired	2.2	2.2	2.1	2.1	2.1	2.0	2.2	2.4	2.5	2.4
Unable to work due to sickness or disability	2.9	3.1	3.3	3.3	3.6	3.5	3.5	3.7	4.0	3.8
Missing	0.9	0.7	0.6	0.7	0.6	0.8	0.7	0.4	0.5	0.7
Total	100	100	100	100	100	100	100	100	100	100

Source: Analysis of QNHS microdata Q2 of each year.

TABLE A1.5 Classification of Economic Activities NACE Rev2

NACE Rev2 Code	NACE Rev2 Description
A	Agriculture, Forestry And Fishing
B	Mining And Quarrying
C	Manufacturing
D	Electricity, Gas, Steam And Air Conditioning Supply
E	Water Supply; Sewerage, Waste Management And Remediation Activities
F	Construction
G	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles
H	Transportation And Storage
I	Accommodation And Food Service Activities
J	Information And Communication
K	Financial And Insurance Activities
L	Real Estate Activities
M	Professional, Scientific And Technical Activities
N	Administrative And Support Service Activities
O	Public Administration And Defence; Compulsory Social Security
P	Education
Q	Human Health And Social Work Activities
R	Arts, Entertainment And Recreation
S	Other Service Activities
T	Activities Of Households As Employers; Undifferentiated Goods and Services-Producing Activities Of Households For Own Use
U	Activities Of Extra Territorial Organisations And Bodies

Appendix 2

Trends in Non-Fatal Injuries Reported to the HSA 2004-2013

In the following tables we outline the trends in the non-fatal injuries reported by workers to the Health and Safety Authority. Chapter 1 highlighted that compared to the CSO data there is significant under-reporting of such injuries across all sectors of the economy. Non-compliance with reporting requirements appears to be particularly acute among the self-employed and among those in smaller organisations. Nevertheless it is instructive to examine whether the trends in HSA reports mirror those found in the QNHS.

In 2013, 6,394 non-fatal injuries resulting in absences of four or more days were reported to the Health and Safety Authority. This represents the lowest number of reported injuries over the ten-year period examined. Taking into account the change in employment levels over the period, the figures suggest a decline in reported injuries per 1,000 workers over the period from 4.1 in 2004 to 3.4 in 2013. The HSA figures do not show the same pre-recession and post-recession shift as the QNHS trends.

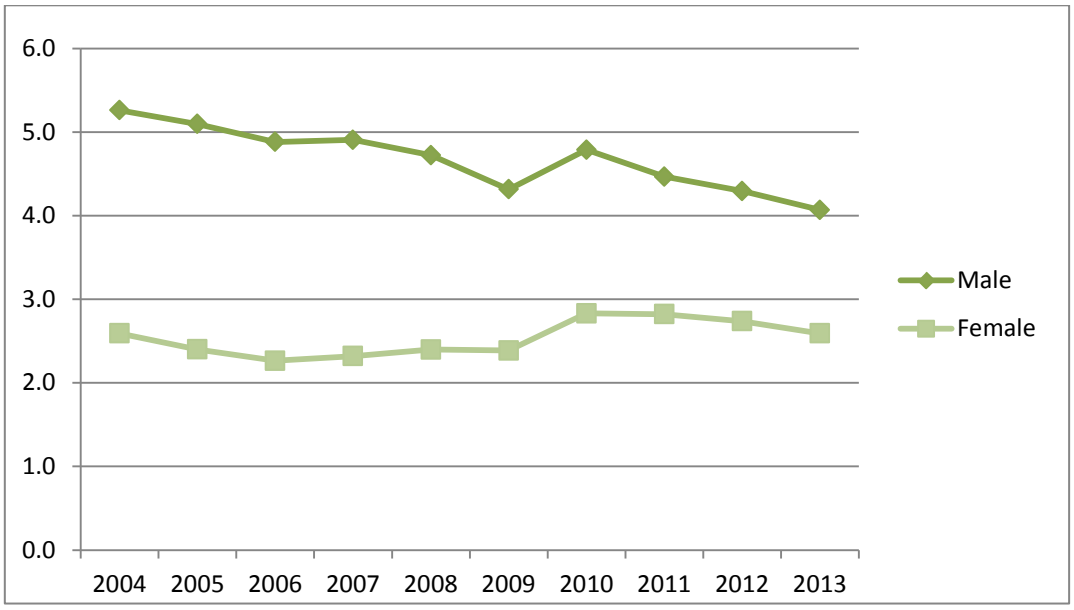
TABLE A2.1 Injuries Reported to the HSA 2004 -2013 Workers Only (> 3 Days Absence)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Reported non-fatal injuries	7,760	7,793	7,761	8,153	7,905	6,779	7,331	6,865	6,589	6,394
Rate per 1, 000 workers	4.1	4.0	3.8	3.8	3.7	3.5	3.9	3.7	3.6	3.4

Source: Health and Safety Authority database, excludes those identified as non-workers, includes small number of cases where employment status was not identified. Employment levels averaged over four quarters of the year based on QNHS figures.

The HSA data also show a significantly lower level of reported injury among female workers compared to male workers. Among men there appears to be a distinct drop in the reported injury rate in 2009, after which the rate returns to 2008 levels and then resumes a more steady pattern of decline. The female reported injury rate follows a different pattern. The period 2004-2006 showed a fall in reported injuries per 1,000 workers, rates were stable between 2006 and 2009, and then rose again in 2010 and remained at a higher plateau for the rest of the period. These trends are likely to be affected by the changing employment levels within sectors so the following tables describe the trends in HSA reports within sectors.

FIGURE A2.1 Reported Injury Rate per 1,000 Workers by Gender (2004-2009) HSA



Source: HSA database.
Note: Rates calculated using the average number employed during the four quarters of the year.

TABLE A2.2 Worker Non-Fatal Accidents Reported to the HSA 2004-2013 by Sector.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Agric, Forestry and Fishing	80	110	98	94	97	92	93	89	77	86
Manufacturing	2,074	2,011	1,953	1,977	1,979	1,438	1,529	1,311	1,348	1,287
Construction	1,341	1,492	1,541	1,558	1,110	656	544	443	411	398
Wholesale, Retail	716	657	685	679	700	580	605	655	706	747
Transportation and Storage	967	960	953	1,053	994	868	1,034	938	821	798
Accommodation and Food	98	154	147	128	169	155	170	176	205	158
Information and Communic	91	86	88	86	100	124	128	90	100	74
Finance, insurance and real estate	193	150	143	174	149	138	152	111	126	95
Profess, Scientific and Tech	18	17	25	45	51	50	61	52	39	50
Admin and Support Service	126	146	113	156	102	172	179	268	216	169
Public Admin and Defence	859	854	926	990	997	920	1,062	978	857	791
Education	99	88	77	76	98	123	159	138	164	160
Health and Social Work	935	928	863	974	1,093	1,217	1,375	1,393	1,342	1,413
Other activities	163	140	149	163	266	246	240	,223	177	168
Total	7,760	7,793	7,761	8,153	7,905	6,779	7,331	6865	6,589	6,394

Source: Health and Safety Authority database.

TABLE A2.3 Composition of Injury Reports to HSA by Sector 2004-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	%	%	%	%	%	%	%	%	%	%
Agriculture	1	1	1	1	1	1	1	1	1	1
Manufacturing	27	26	25	24	25	21	21	19	20	20
Construction	17	19	20	19	14	10	7	6	6	6
Wholesale, Retail	9	8	9	8	9	9	8	10	11	12
Transportation and Storage	12	12	12	13	13	13	14	14	12	12
Accommodation and Food	1	2	2	2	2	2	2	3	3	2
Public Admin and Defence	11	11	12	12	13	14	14	14	13	12
Education	1	1	1	1	1	2	2	2	2	3
Health and Social Work	12	12	11	12	14	18	19	20	20	22
Other services	8	7	7	8	8	11	10	11	10	9
	100	100	100	100	100	100	100	100	100	100

Source: Health and Safety Authority database.

Notes: Difference across years statistically significant P <.001

Other services: combines the categories Information and Communication, Finance, insurance and real estate, Professional, Scientific and Technical, Admin and Support Service, and other activities.

Table A2.2 shows the very substantial changes in the number of injuries reported to the HSA in some sectors in the boom and recessionary periods. At the peak of the construction bubble in 2007, 1,558 injuries were reported among construction workers, and for the period 2004 until 2008 construction injuries accounted for a fifth or more of all injuries (Table A2.3). In contrast numbers of injuries in the health sector continued to rise over the period and came to account for a greater proportion of the reported injuries, rising from 12 per cent in 2005 to 22 per cent in 2013. While some of this change is accounted for by the changing levels of employment in these sectors, this is not the full story.

Appendix 3

Additional Models

TABLE A3.1 Odds of Injury and Illness by Year (Logistic Regression)

	Injury		Illness	
	Odds	Sig.	Odds	Sig.
Ref: year 2001	1.000		1:00	
2002	.919	ns	1.131	ns
2003	1.157	.039	1.425	.000
2004	1.084	ns	1.573	.000
2005	1.091	ns	1.703	.000
2006	1.066	ns	1.829	.000
2007	1.140	.045	1.464	.000
2008	.803	.002	1.089	ns
2009	.645	.000	.859	.071
2010	.846	.022	1.124	n.s
2011	.845	.021	1.430	.000
2012	.709	.000	1.458	.000
Constant	.027	.000	.019	.000

Source: QNHS Annual Modules on Work-Related Accidents and Illness.

TABLE A3.2 Logistic Regression Model of Injury Risk Including Year on Year Percentage Change in Employment by Economic Sector

	Model 1		Model 2		Model 3	
	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.
% Employ change[1]	1.010	0.192	1.015	0.000	1.010	0.011
Female			0.618	0.000	0.618	0.000
Age			0.989	0.000	0.989	0.000
Non-Irish			0.836	0.023	0.845	0.033
Sector ref = Service						
Agriculture			1.943	0.000	1.872	0.000
Industry			1.492	0.000	1.443	0.000
Construction			2.456	0.000	2.406	0.000
Retail			1.400	0.000	1.384	0.000
Transport			1.577	0.000	1.565	0.000
Accommodation			1.564	0.000	1.548	0.000
Health			1.764	0.000	1.794	0.000
Tenclt6			0.800	0.009	0.792	0.006
Tenclt12			0.876	0.104	0.869	0.083
TenLT2yrs			0.999	0.989	0.996	0.959
Ten35yrs			1.165	0.001	1.164	0.001
Hours vary			1.332	0.001	1.329	0.001
30-39 hours			1.181	0.021	1.178	0.023
40-49 hours			1.360	0.000	1.359	0.000
50 plus hours			1.335	0.002	1.331	0.003
Shift work			1.627	0.000	1.631	0.000
Night work			1.217	0.003	1.216	0.003
Self-employed			0.978	0.727	0.977	0.710
Inspect Rate					0.923	0.003
Constant	0.025	0.000	0.022	0.000	0.040	0.000

Source: QNHS micro-data.

Note: [1] Annual percentage employment change by sector.
The logistic regression used corrected standard errors using the VCE procedure in Stata to take account of correlation of errors within groups of percentage employment change (See Moulton 1990).

TABLE A3.3 Logistic Regression of Injury Risk (0+ Days Absent) Excluding 2009

	Odds Ratio	Sig.	Odds Ratio	Sig.
Recession '08-12	.848	.001		
% Emp change			1.007	.016
Female	.625	.000	.627	.000
age	.989	.000	.989	.000
Non-Irish	.884	.014	.865	.004
Sector ref=service				
Agriculture	1.851	.000	1.850	.000
Industry	1.445	.000	1.439	.000
Construction	2.444	.000	2.427	.000
Retail and wholesale	1.333	.000	1.336	.000
Transport	1.352	.000	1.552	.000
Accomm and food	1.480	.000	1.522	.000
Health	1.749	.000	1.768	.000
Job tenure ref >5yr				
< 6 months	.773	.000	.769	.000
6-12 months	.853	.011	.857	.013
13 months-2yrs	.968	.561	.974	.637
3-5yrs	1.149	.001	1.153	.000
Hours ref <30hours				
Hours vary	1.348	.000	1.352	.000
30-39 hours	1.151	.005	1.159	.003
40-49 hours	1.336	.000	1.337	.000
50 plus hours	1.305	.000	1.322	.000
Shift work	1.585	.000	1.583	.000
Night work	1.252	.000	1.252	.000
Ref: Employee				
Self-employed	.954	.343	.951	.306
Inspection rate	.979	.348	.936	.001
Agric *recess	.766	.085		
Indust *recess	.774	.018		
Con*recess	.865	.247		
Retail*recess	.975	.821		
Transport*recess	1.531	.001		
Accom*recess	1.045	.738		
Health*recess	1.102	.343		
Constant	.030	.000	.038	.000

Source: QNHS.

TABLE A3.4 Injury Model for Those With Tenure of One Year or More Including Employment Change

	Exp(B)	Sig.
Annual % change in employment	1.010	.000
Female	.583	.000
Age	.989	.000
Non-Irish	.923	.141
Agric	1.856	.000
Industry	1.449	.000
Construct	2.426	.000
Retail	1.374	.000
Transport	1.461	.000
Accom	1.458	.000
Health	1.870	.000
Self-Emp	.986	.785
Tenure < 2yrs	.975	.639
Tenure 3-5yrs	1.138	.001
Hours Vary	1.261	.001
30-39 hours	1.166	.005
40-49 hours	1.315	.000
50 plus hours	1.316	.000
Shift	1.652	.000
Night	1.204	.000
Inspection Rate	.936	.000
Constant	.039	.000

Source: QNHS micro-data.

TABLE A3.5 Risk of Work-Related Illness (0+days absent): Including Annual Percentage Change in Employment by Sector

	Odds	Sig.	Odds	Sig.
% emp change	1.01	.000	1.00	.175
Female	1.09	.017	1.09	.018
Age	1.06	.000	1.06	.000
Age squared	1.00	.000	1.00	.000
Non-Irish	.83	.001	.85	.003
Agriculture	1.37	.000	1.28	.000
Industry	.95	.319	.89	.028
Construction	1.29	.000	1.24	.000
Retail and wholesale	.88	.010	.86	.003
Transport	1.06	.414	1.04	.555
Accomm and food	.68	.000	.66	.000
Health	1.20	.000	1.24	.000
Job tenure ref: > 5 years				
< 6 months	.95	.388	.93	.291
6-12 months	.75	.000	.74	.000
13 months-2yrs	.86	.009	.85	.007
3-5yrs	1.01	.824	1.01	.870
Weekly Hours ref:30-39				
Hours vary	1.32	.000	1.32	.000
LT 10 hours per week	.71	.011	.72	.012
10-19 hours	.88	.066	.89	.078
20-29 hours	.96	.412	.96	.455
40-49 hours	1.00	.997	1.00	.961
50 hours or more	1.30	.000	1.30	.000
Self-employed	1.04	.434	1.04	.424
Shift work	1.27	.000	1.27	.000
Night work	1.25	.000	1.25	.000
Inspection rate			.87	.000
Constant	.01	.000	.01	.000

Source: QNHS micro-data.

TABLE A3.6 Logistic Regression of Illness Risk (0+ Days Absent) Excluding 2009

	Odds	Sig.	Odds	Sig.	Odds	Sig.	Odds	Sig.
Recession	.83	.000	.83	.000	.82	.000	.73	.000
Female	.95	.115	.97	.429	1.10	.008	.98	.579
Age	1.08	.000	1.08	.000	1.06	.000	1.06	.000
Age Squared	1.00	.000	1.00	.000	1.00	.000	1.00	.000
Non-Irish	.84	.001	.87	.009	.89	.045	.89	.031
Sector Ref=Service								
Agriculture			1.63	.000	1.24	.001	1.22	.008
Industry			.90	.026	.86	.003	.80	.000
Construction			1.19	.002	1.22	.000	1.15	.036
Retail and Wholesale			.84	.001	.85	.002	.77	.000
Transport			1.21	.004	1.05	.494	1.01	.865
Accomm and Food			.75	.000	.65	.000	.57	.000
Health			1.36	.000	1.22	.000	1.32	.000
Self-Emp					1.04	.408	1.05	.349
Job Tenure Ref >5yr								
< 6 Months					.91	.171	.92	.210
6-12 Months					.72	.000	.72	.000
13 Months-2yrs					.81	.000	.81	.001
3-5yrs					.99	.813	.99	.873
Hours Ref <30hours								
Hours Vary					1.43	.000	1.44	.000
Hours 30-39					1.08	.075	1.09	.054
Hours 40-49					1.08	.133	1.09	.100
Hours 50 Plus					1.39	.000	1.40	.000
Shift Work					1.27	.000	1.27	.000
Night Work					1.25	.000	1.24	.000
Female *Recess							1.41	.000
Agriculture*Recess							1.01	.940
Industry*Recess							1.24	.045
Construct*Recess							1.18	.187
Retail* Recess							1.28	.021
Transport*Recess							1.10	.487
Accommodation*Recess							1.42	.026
Health*Recess							.82	.048
Inspection Rate							.92	.000
Constant	.01	.000	.01	.000	.01	.000	.01	.000

Source: QNHS micro-data.

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