The Determinants of Injury Compensation Claims in a Universal Claims Environment

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Abstract

Injury compensation claims data are frequently used to measure injury trends; however other factors can influence claiming behaviour, such as the financial incentives within the insurance setting. Previous studies have looked at the determinants of claims within a workers' compensation claims environment. I make a unique contribution by looking at the determinants of claims within the universal no-fault accident compensation environment in New Zealand. The determinants are expected to differ from previous studies due to the different claiming incentives in a universal environment.

Chapter 2 provides some background on the legislative settings and chapter 3 reviews what is known in the literature about the determinants of injury claims. Chapter 4 describes the economic theory used to consider incentives in a universal claims environment and contrasts it with a workers' compensation environment. I describe the data used for this research in chapter 5. The source is the Statistics New Zealand Integrated Data Infrastructure, an anonymised longitudinal linked unit record dataset.

In chapter 6 I use data on self-reported injury to look at how many injured people have an accepted compensation claim. I find that a third of people with a self-reported injury at work did not have an ACC claim. There is no significant difference in claiming rates between work and non-work injuries. Propensity to claim varies by age and ethnicity, most likely reflecting attitudes and access to healthcare treatment. The findings indicate that access to healthcare may be a stronger determinant for claiming work-related injury under workers' compensation than the requirement for proof that the injury is work-related.

In chapter 7, I investigate a policy intervention, experience rating, which aims to incentivise employers to improve safety but may inadvertently result in underreporting of injury claims. I find that experience rating is associated with a small, but not statistically

significant, decrease in work claims, with some possible spillover effects in reducing off-the-job injury. This suggests that, on average, any decrease in work claims was not achieved through shifting claims from the work account to the earners' account.

Having studied underreporting of claims, chapter 8 looks at a section of the literature on overreporting of claims. Research in a workers' compensation environment consistently finds a higher number of injuries on a Monday (Campolieti & Hyatt, 2006; Card & McCall, 1996). One theory is that workers claim off-the-job weekend injuries as occurring on the Monday at work to receive workers' compensation. I test this within the New Zealand environment in which compensation is identical for both types of injuries. I find excess claims for work and off-the-job injury on Mondays. I also find excess claims on a Tuesday. This indicates that incentives in a workers' compensation environment to fraudulently claim weekend injuries as happening at work on the Monday is likely to only be part of the explanation for excess claims at the start of the week.

Claims data provide a powerful source of information about the injury environment. The findings in this thesis indicate that a universal claims environment generally promotes lodgement of injury claims and discourages misreporting to a greater extent than that found under workers' compensation schemes.

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Ethics Approval

Ethics approval was obtained from the University of Otago Ethics Committee.

Statistics New Zealand Disclaimer

Note: This is a standard disclaimer that all users of the IDI data are required to use.

The results in this thesis are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI), managed by Statistics New Zealand.

The opinions, findings, recommendations, and conclusions expressed in this thesis are those of the author, not Statistics NZ, WorkSafe New Zealand or ACC.

Access to the anonymised data used in this thesis was provided by Statistics NZ under the security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person, household, business, or organisation, and the results in this thesis have been confidentialised to protect these groups from identification and to keep their data safe.

Careful consideration has been given to the privacy, security, and confidentiality issues associated with using administrative and survey data in the IDI. Further detail can be found in the Privacy impact assessment for the Integrated Data Infrastructure available from www.stats.govt.nz.

The results are based in part on tax data supplied by Inland Revenue to Statistics NZ under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information may be published or disclosed in any other form, or provided to Inland Revenue for administrative or regulatory purposes.

Any person who has had access to the unit record data has certified that they have been shown, have read, and have understood section 81 of the Tax Administration Act 1994, which relates to secrecy. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes and is not related to the data's ability to support Inland Revenue's core operational requirements.

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Chapter 1

Introduction

Evaluations of injury prevention programmes commonly use workers' compensation claims data as an indicator of injury; however, the occurrence of an injury is not the only determinant of whether a claim is lodged and accepted. Claims will underrepresent injuries in cases where no claim is made or if the injury is not eligible for compensation (underreporting). Alternatively claims will over-represent injury if fraudulent claims go undetected (overreporting). The use of claims data in research and evaluation will produce biased results if the trend in misreporting differs from the trend in injuries. It will also misrepresent the distribution of injury if propensity to claim varies by different person or firm characteristics or if there are incentives to misrepresent details of the injury such as the setting (e.g., whether the injury occurred at work or at home).

For injury insurers, regulators, policymakers or employers, potential impacts of unwittingly depending on biased results include underinvestment in workplace injury prevention, incorrect conclusions as to the effectiveness of injury prevention programmes and inequitable funding of compensation for work injury. Depending on the form that claiming incentives take, it may also have a negative impact on the physical and mental wellbeing of injured workers. However, depending on who is monitoring injury trends, such bias may not be perceived to be a problem. For example, if an insurer is looking at means to reduce claims, they may logically favour reducing their costs rather than considering injury reduction per se.

This thesis examines three aspects of the determinants of claiming within a universal scheme:

1. The proportion of people who do not receive injury compensation following an injury and their characteristics (chapter 6);
2. The impact of a particular financial incentive scheme (Experience rating) in relation to whether it inadvertently increases misreporting (chapter 7); and
3. A day-of-the-week effect in workers' compensation claims in relation to whether it is caused by people claiming off-the-job injuries as occurring at work (chapter 8).

The research uses data sourced from the Statistics New Zealand Integrated Data Infrastructure (IDI). The IDI is a linked longitudinal dataset of administrative unit-record data for the full population of individuals and firms. The core population of the IDI (the 'spine') is sourced from tax data, immigration visas and birth records. Other types of information have been linked to the IDI spine, such as accident compensation claims and Statistics New Zealand survey data.

This thesis makes a unique contribution to the literature by utilising two important differences between the New Zealand accident compensation scheme and those found in other countries. Firstly, whenever a person seeks treatment for an injury in New Zealand (e.g., visits a doctor, dentist, physiotherapist); they are asked to complete a claim form. The treatment provider sends the form to the insurance provider on the patient's behalf. This differs from some schemes where the employer submits the claim for workers' compensation on the employee's behalf. A requirement for workers to inform their employers of an injury can discourage some workers from claiming (Taylor Moore, Cigularov, Sampson, Rosecrance, & Chen, 2013).

Second, New Zealand provides comprehensive injury cover for everyone in New Zealand – including workers in all industries, the self-employed, non-earners, and tourists. This feature allows me to test hypotheses on misreporting of work claims as non-work claims (and vice versa) and I can test whether results found in other countries using workers' compensation data also apply to non-work injury.

By using data from the IDI this thesis includes information on both claimants and non-claimants and has a broader suite of firm characteristics than that typically sourced from claims data alone.

The thesis is structured as follows. Chapter 2 describes the legislative settings of the universal claims environment studied here. Chapter 3 sets the scene by outlining what is known from the literature about the determinants of injury claims. Chapter 4 describes the formal economic theory of incentives in a universal claims environment. The IDI data used for this research is described in chapter 5. Chapters 6, 7 and 8 each examine a different aspect of the determinants of claiming within a universal environment. Chapter 9 concludes.

Chapter 2

Legislative Settings

The universal injury claims environment in New Zealand, is central to this study of the determinants of claiming for workplace injury. This chapter outlines the legislative settings in New Zealand and describes how they differ from other countries.

2.1 The Accident Compensation Act

The New Zealand Accident Compensation Corporation (ACC) was established in 1974 under the Accident Compensation Act 1972 and the 1973 Amendment to the Act. The no-fault personal injury scheme is based on recommendations in the Woodhouse Report (*Compensation for Personal Injury in New Zealand: Report of the Royal Commission of Inquiry* 1967) which focuses on the five principles of community responsibility, comprehensive entitlement, complete rehabilitation, real compensation and administrative efficiency.

Under the Act, everyone in New Zealand receives comprehensive injury cover (including tourists and self-employed workers). When a person seeks treatment for an injury (e.g., visits a doctor, dentist, physiotherapist) they are asked to complete an ACC form, irrespective of who they are, how the injury occurred, and level of awareness of entitlements. The treatment provider completes information on initial diagnosis and ability to work (if relevant) and sends the form to ACC on the patient's behalf. Private health insurance coverage does not overlap accident insurance, rather it provides additional coverage to complement that which is provided by ACC. Therefore, claims made under the scheme provide reasonably complete coverage of injuries in New Zealand, for which treatment is sought from doctors, dentists and physiotherapists.

In New Zealand, there is a one-week stand-down period for loss of earnings compensation. If it is a work injury, this excess is paid for by the employer (Accident Compensation Act 2002 s97); if it is a worker injured off-the-job, it is paid through sick leave or annual leave employment entitlements (Accident Compensation Corporation, 2017b). ACC pays weekly compensation of 80% of pre-injury earnings (Accident Compensation Act 2002, sch 1 s32). The current gross maximum rate of weekly compensation payable is NZ$1,940.75 per week (applies from 1 July 2017 to 31 June 2018) (Accident Compensation Corporation, 2017a).

2.2 Scheme funding

Funding for the scheme is split into five accounts (Accident Compensation Corporation, 2015c). Eligibility for injury cover does not vary by the account used.[1]

- The Work Account, funded by a levy on employers and self-employed workers and shareholder-employees. It covers work injuries for people in paid employment.
- The Earners' Account, funded by a levy on earnings. It covers non-work injuries to people in paid employment.
- The Motor Vehicle Account, funded by a levy included in the price of petrol and the motor vehicle licensing fee. It covers all injuries involving motor vehicles on public roads (including work-related, earner and non-earner injuries).
- The Non-Earners' Account, funded from general taxation. It covers injuries for people not in paid employment. This includes students, beneficiaries, retired people, tourists and children.

[1] The focus of this thesis is injuries, for which eligibility does not vary by funding account; however, eligibility for cover for gradual process injury, disease and illness only apply if it is work-related (the work account).

- The Treatment Account, funded by the Earners’ and Non-Earners’ Account. It covers injuries that are caused by, or happen during, medical treatment.

2.3 Legislative change

There have been several major changes to the scheme since it was established. Some of the shifts in the scheme’s focus can be seen reflected in changes to the name of the Act as shown in Figure 2.1 (Accident Compensation Corporation, 2015b).

In 1982 the scheme was reviewed in response to the rising costs. Among other changes, it went from being fully funded to pay-as-you-go; work-related motor-vehicle accidents were moved from the Work Account to the Motor Vehicle Account; and wage replacement compensation was reduced from 100 percent of wages to 80 percent.

In 1992 the scheme was reviewed in terms of fairness. Among other changes, the earners’ account was introduced (previously funded from the work account), experience rating was introduced for the work account (individual employers receive penalties or discounts on their levies based on their own claims performance), lump sum compensation payments were replaced by periodic payments, and the accredited employers programme was introduced. The accredited employers programme is a programme whereby employers who have been verified by ACC as having good health and safety systems can choose to take on some of the risks and claims management for work-related injury for their employees, in exchange for a levy reduction. These accredited employers tend to be large businesses.

In 1999 workers’ compensation was opened to the private market. ACC was no longer allowed to provide workers’ compensation, although self-employed workers could choose to stay with ACC; however, this only lasted for one year. Work Account claims data in 1999 are not a reliable reflection of work injury claims paid because not all insurers reported claim numbers to ACC. The drop in the number of work account claims during this period can be seen in Figure 2.2. From 1 July 2000 ACC was restored as the sole provider of workplace accident insurance, the scheme was shifted from pay-as-you-go to fully-funded and ACC re-established the Accredited Employers Programme.

Later in the 2000s, changes were made to increase focus on injury prevention and rehabilitation and broaden the types of injury covered. In 2005 medical misadventure became covered as part of no-fault insurance and was renamed treatment injury. The definition of injury was also extended to include poisoning from mushrooms and injuries sustained from twisting. In 2008 coverage was extended to include mental health problems resulting from an injury and some of the barriers to claiming for occupational gradual-process were reduced. In 2010 a provision was introduced enabling a separate motorcycle levy.

2.4 A model of the drivers of claims

All injuries that result from an accident are eligible for accident compensation in New Zealand, irrespective of whether it was work-related. This should increase uptake of accident compensation in New Zealand, relative to other countries; however, some eligibility requirements remain. For example, ACC only covers injuries caused by accidents, it does not cover things such as illness (e.g., measles), conditions from ageing (e.g., arthritis) and emotional issues (e.g., stress). Although ACC covers work-related gradual process injury, disease and infection, there are specific requirements that need to be met under s30 of the Accident Compensation Act 2001 for such a claim to be compensable (e.g., the claimant performs an employment task that causes or substantially contributes to the harm and it is not found to any material extent in the non-employment activities or environment of the person).

In an analysis of ACC appeals processes, Powell, Forster, Barraclough, and Mijatov (2015) find that there are systematic barriers to people who appeal ACC decisions. These appeals relate to both the initial claim acceptance decision, and subsequent decisions regarding entitlements following acceptance of a claim. During the study period, it was estimated that of the 10-12 million claims lodged with ACC, 6 million were declined, and 40,000 were appealed. The report identifies that the need for an injured person to provide proof is a major issue in the judgement. An injured person is required to prove exactly what their injury is, to prove that their injury is caused by an accident and to prove that their need for entitlements is caused by the injury.

Figure 2.3 displays the ACC model of the drivers of claims. Important influencers on the number of claims filed as identified in the model include the seriousness of injury, the cost and accessibility of treatment, the impact on work, and the treatment provider's beliefs about the value of claiming and the likelihood of a claim being accepted. Whether or not claims are accepted by ACC depends on the policy and operational settings that determine eligibility when the claim is made, including the standard of proof required (R. W. Hansen, MacAvoy, & Smith, 1989). Changes to any of these influencers may alter accepted claim numbers without changing injury incidence.

2.5 Funding of health services

Accident compensation in New Zealand, sits within a mixed private-public funding model for primary healthcare and a fully-funded publicly-provided secondary healthcare model. Primary health care services are funded through District Health Boards (DHBs). Funding is based on the number of people enrolled with a Primary Health Organisation (PHOs), and the demographic composition of their enrolled population, rather than the number of visits (Ministry of Health, 2014); although general practitioners (GP) retain the right to charge user-fees (Ministry of Health, 2017b). Primary health care subsidies have been found to be effective at targeting those most likely to have the greatest need for health services (Cumming, Stillman, & Poland, 2009).

Unlike primary health care, public hospitals are fully-funded and elective services are managed on a prioritisation basis. Hospital treatment is free, irrespective of whether the person has an injury or illness. The hospital receives funding from ACC to cover the injury treatment costs and from the DHB to cover treatment for other reasons (e.g., illnesses). There are some private hospitals available for those willing to pay for non-urgent treatment. Although New Zealand has a private health insurance market, it is relatively small (The Treasury, 2014). In 2015, 71% of healthcare expenditure was funded by the government, 9% through accident compensation insurance, 5% by voluntary private health insurance and 15% by user charges (OECD, 2017). Figure 2.4 displays the structure of the New Zealand health and disability sector.

2.6 How this differs from other countries

In this section, I compare New Zealand to three other countries that use workers' compensation data for injury prevention research – the United States (US), Canada and Australia. The commonality across each of these countries is that there is a compulsory no-fault workers' compensation scheme. In some states in the US and Australia there are private insurers as well as state insurers (Institute for Work and Health, 2010; Safe Work Australia, 2016). In New Zealand and Canada, the insurance is provided solely by the state, although in Canada the provider varies across provinces while in New Zealand, it is a single insurer.

New Zealand has a broader coverage across different types of workers than other countries. Everyone who works or owns a business in New Zealand, pays accident compensation levies and is entitled to workers' compensation (Accident Compensation Corporation, 2017d). In contrast, other countries typically exclude some categories of workers, such as self-employed, independent contractors, agriculture workers, domestic workers, or small businesses (e.g., fewer than three employees) (Association of Workers'

Compensation Boards of Canada, 2016; Safe Work Australia, 2016; Spieler & Burton, 2012). It is estimated that about 24 percent of jobs in the US (McLaren & Baldwin, 2017) and 30 percent of the labour force in Ontario (Mustard, Chambers, McLeod, Bielecky, & Smith, 2012) are not covered by workers' compensation .

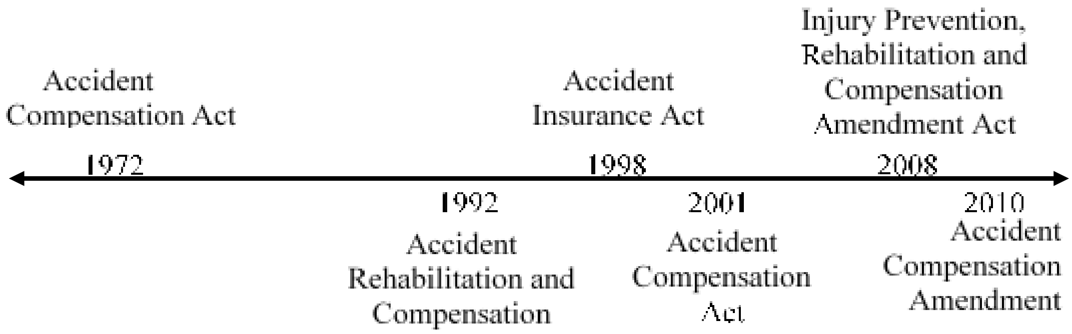
New Zealand, Australia and Canada have a public health care system whereby people have access to subsidised treatment whether the injury happened at work or not. The system in the US is more complex, with private health insurance generally required to cover treatment costs for injuries outside of work (see Figure 2.5). Consequently, in the US, a worker pays less for injury treatment if it happens at work than if it had happened off-the-job, potentially incentivising people to claim off-the-job injury as occurring at work.

In New Zealand, people have access to loss of income compensation if they require more than a week off work to recover from their injury, whether the injury occurred at work or not. In Australia, Canada and the US, injured people are only entitled to loss of income compensation if the injury happened at work. Consequently, in Australia, Canada and the US, a worker receives higher benefits if the injury happens at work than if it had happened off-the-job, also potentially incentivising people to claim off-the-job injury as occurring at work.

In this thesis I look at whether the determinants of claims within New Zealand's universal claims environment differ from those found in Australia, Canada and the US. I expect to find some differences since the nature of the New Zealand scheme simplifies the claims process and reduces incentives for claiming off-the-job injury as occurring at work. In the next chapter I provide further background on the topic and review the literature on the determinants of injury claims.

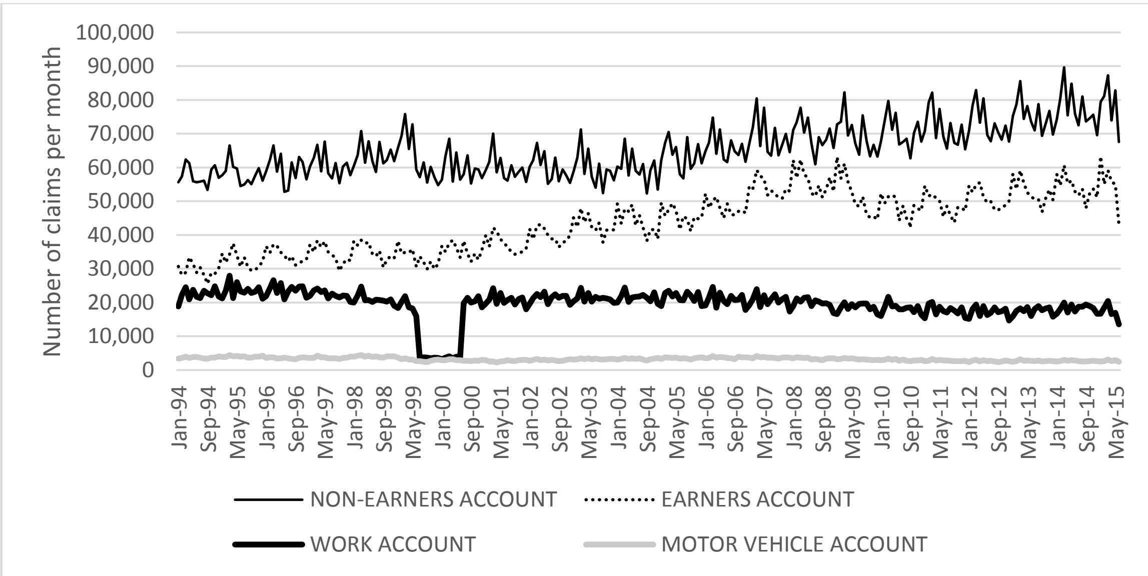
2.7 Figures and Tables

Figure 2.1: Timeline of changes to the name of the Accident Compensation Act



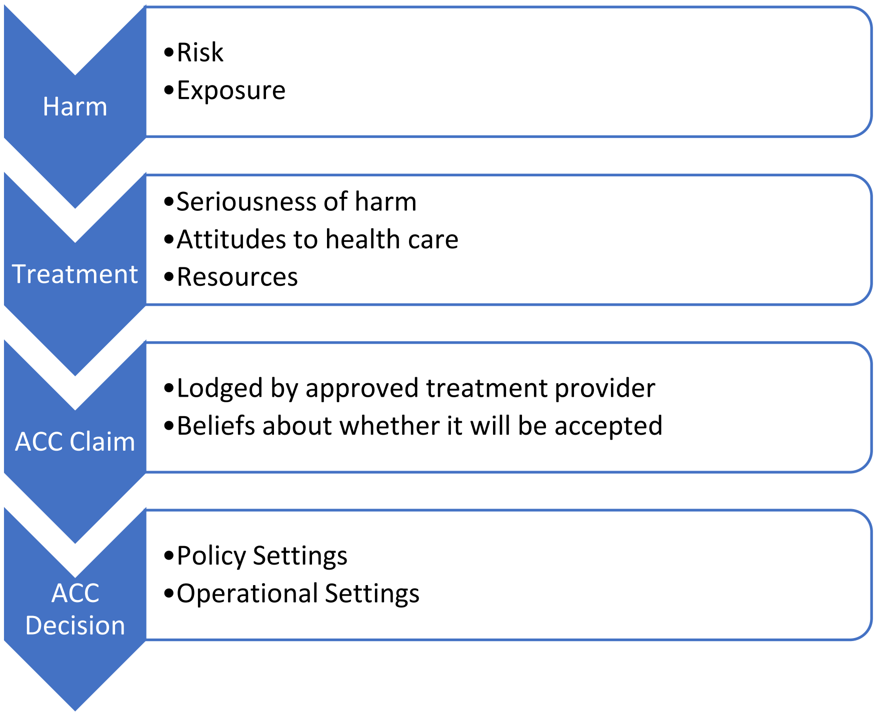
Source: Accident Compensation Corporation (2015b)

Figure 2.2: Number of claims per month per funding account



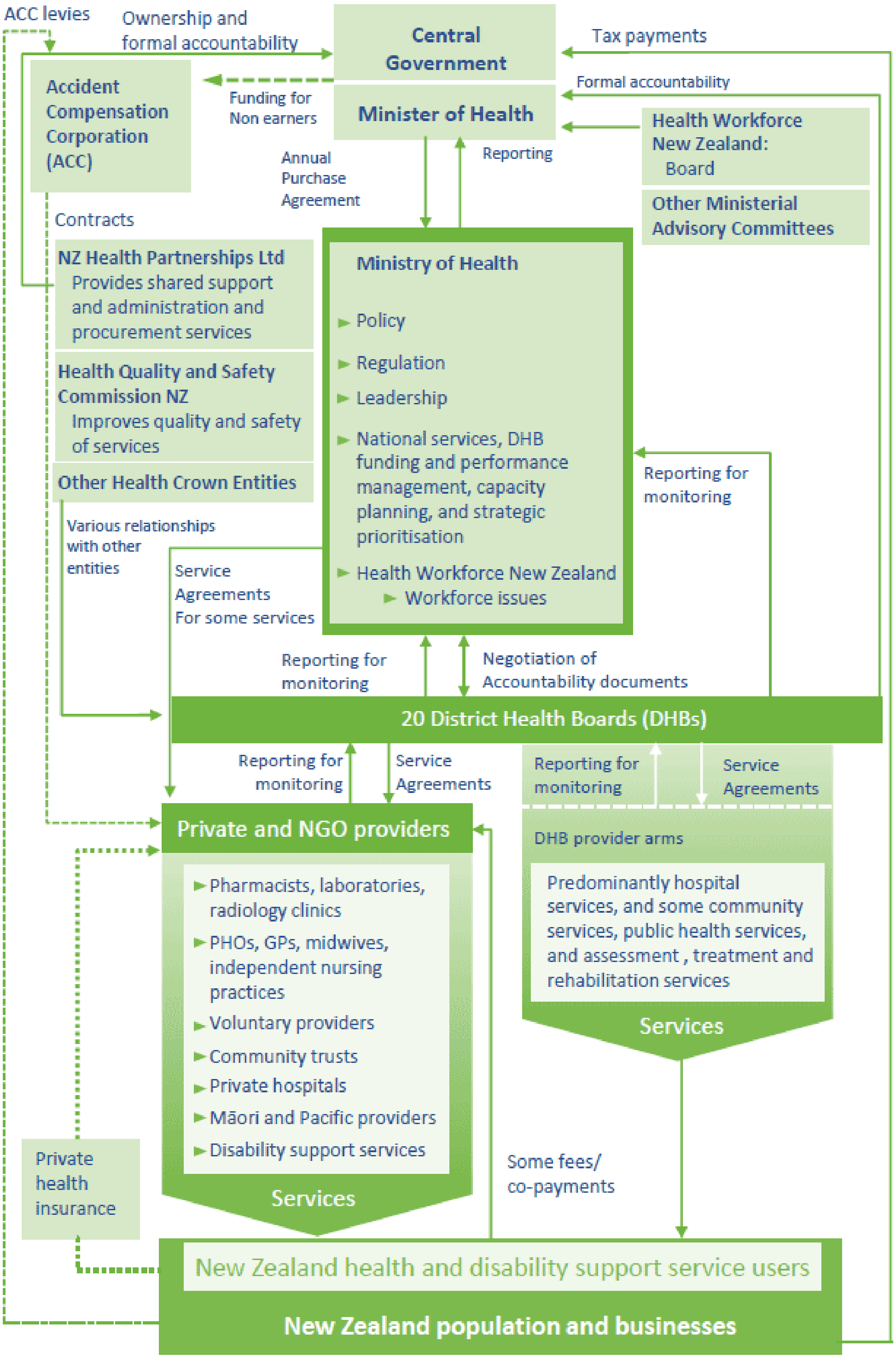
Source: ACC claims in the IDI

Figure 2.3: Modelling the drivers of ACC claim growth



Source: Adapted from an ACC presentation (John Wren, Guevara, Sigglekow, & Pittams, 2015)

Figure 2.4: The Structure of the New Zealand health and disability sector



Source: Ministry of Health (2017a)

Figure 2.5: Health and disability funding comparison across four countries

	New Zealand	Australia	Canada	United States
Work-injuries – treatment and loss of income	Accident compensation	Workers' compensation	Workers' compensation	Workers' compensation
Occupational disease – treatment and loss of income	Accident compensation	Workers' compensation	Workers' compensation	Workers' compensation
Non-work injuries - treatment	Accident compensation	Public health care	Public health care	*Sometimes but not comprehensive e.g., Medicare, Medicaid*
Non-work injuries – loss of income	Accident compensation			
Injuries resulting from a health condition - treatment	Public health care	Public health care	Public health care	*Sometimes but not comprehensive e.g., Medicare, Medicaid*
Injuries resulting from a health condition – loss of income	*In all four countries, private income insurance is required to cover loss of income relating to a health condition, although sickness benefits are available.*			

Chapter 3

Literature Review and Background

3.1 What is injury?

The mechanism of injury is often defined in public health using the Haddon (1973) concept of bodily harm resulting from the transfer of energy; however this definition excludes some types of harm, such as psychological harm resulting from sexual abuse, that are often considered injury (Langley & Brenner, 2004). In practice, injury insurers decide whether to accept a claim as an injury and, where disputed, the courts determine it. The ambiguity associated with the definition of injury represents a challenge in quantifying misreporting of injury. This is generally addressed in the literature by assuming that the gap in reporting between two or more injury surveillance systems represents a lower bound on injury underreporting. An example is displayed in Figure 3.1. If the first data source consists of A and B and the second data source consists of B and C (where B is the overlap between the two data sources), then the lower bound on injury underreporting for the first data source is assumed to be equal to C. I have applied this practice here.

3.2 Injury surveillance systems

Injury surveillance systems capture time series information about how many people are injured, the characteristics of injured people, how the injuries occurred and the risk factors associated with the injuries (Holder et al., 2001). This information can be used to assess the need for injury prevention efforts by quantifying the size and cost of the problem; target interventions through analysis of characteristics associated with injuries; and evaluate the effectiveness of injury prevention efforts. Surveillance systems are usually based on administrative data, such as hospital records, as these are more affordable sources of time series data than primary data collection (although repeat surveys are sometimes used). A summary of some of the more commonly used data sources are displayed in Figure 3.2.

3.3 Misreporting of injury within compensation claims data

In this thesis I investigate the use of injury compensation claims within the context of an injury surveillance system. One of the challenges with using administrative data to monitor injuries is that trends may be driven by factors other than injury risk, such as trends in health care utilisation (Cryer & Langley, 2008). If the data are used without consideration of these drivers it could lead to incorrect conclusions about the need for investment in injury prevention, inequitable distribution of injury prevention resources and inaccurate assessments regarding the effectiveness of injury prevention programmes.

The extent to which a surveillance system over- or under- represents injury is referred to in this thesis as ‘misreporting’. I use the term ‘underreporting’ when claims data are missing some injuries and the term ‘overreporting’ where there are more claims than injuries (e.g., fraudulent claims). This does not imply that there are inaccuracies in the collection of information by the accident insurer, but rather a misalignment between the information collected to administer injury compensation and the secondary use of this information for injury surveillance.

3.4 Estimates of injury underreporting

The extent of injury underreporting within workers’ compensation varies across studies and jurisdictions, with estimates ranging from about 30 percent (Shannon & Lowe, 2002) to 83 percent (Safe Work Australia, 2011); however, if one compares like with like, the results are remarkably consistent across countries. For example, a 2003

Canadian study finds that 35 percent of respondents with injury or illness do not make a claim (Mustard et al., 2003), while a more recent Australian survey of workers with an injury or illness produces the very similar result of 36 percent (Safe Work Australia, 2011).

Reporting of workers' compensation claims tends to be higher for injuries and lower for occupational illnesses, possibly due to variation in latency and ease of attribution to work. Underreporting of workers' compensation claims is estimated to be approximately:

- 30 percent for those with a work-related injury (excluding work-related illness) (Shannon & Lowe, 2002);
- 35 percent for those with a work-related injury or illness (Mustard et al., 2003; Safe Work Australia, 2011)
- 42 percent for those with a work-related musculoskeletal injury (gradual process) (Biddle & Roberts, 2003); and
- 69 percent for those with suspected occupational silicosis (occupational disease) (Stanbury, Joyce, & Kipen, 1995).

The degree of reporting is also related to the seriousness of the injury or illness. The above estimates of non-claiming behaviour are based on injuries that resulted in a week or more away from work. If more minor injuries are included, the estimated degree of underreporting increases substantially (Biddle & Roberts, 2003; Rosenman et al., 2000; Safe Work Australia, 2011; Shannon & Lowe, 2002). This pattern is shown in Figure 3.3.

3.5 Reasons for not claiming

The main method used to identify the reasons why employees do not report work-related injury is to survey employees and ask them (Biddle & Roberts, 2003; Tucker, Diekrager, Turner, & Kelloway, 2014). This section structures the literature on the reported reasons for not making a claim under six common themes.

3.5.1 They did not think they were eligible for compensation

Eligibility for injury compensation varies across jurisdictions. Self-employed workers, unpaid (voluntary) workers, and bystanders (people not working at the time of injury but injured from someone else's work activity) are commonly (but not always) excluded from workers' compensation schemes. For example, about 30% of the labour force in Ontario is in employment situations not covered by workers' compensation (Mustard et al., 2012). In such environments, a change in the labour market towards informal work practices will result in a decrease in the proportion of workers eligible for workers' compensation. This decreases the proportion of the working population who make a claim following injury and may increase potential claimants' uncertainty about their coverage because not everyone is covered.

3.5.2 They were uncertain as to whether the injury was work-related.

In countries where people are only eligible for compensation if the injury is work-related, assumptions regarding work-relatedness are important in the decision on whether to lodge a claim. Interestingly, this has been found to apply even when a person has been advised by a health professional that their condition is work-related. Biddle and Roberts (2003) find that 21 percent of workers identified by physicians as having work-related pain did not make a workers' compensation claim because they did not think the pain was work-related.

The structure of the questions when researching this topic is likely to be of importance. In a similar study, Tucker et al. (2014) find that only three percent of workers gave this reason for not reporting lost time work-related injury. The lower estimate by Tucker et al.

(2014) may be because workers were asked whether they had a work-related injury that caused them to miss time from work before they were asked whether they had reported the injuries (and if not why not). If workers were not sure if it was work-related they may have responded in the negative to the first question and therefore were not captured in the follow-up question. In contrast, Biddle and Roberts (2003) collect data from people diagnosed by physicians as having work-related pain. By using an independent source of data on work-relatedness, they capture more people who did not think their pain was work-related.

Changes over time to the standard of proof required from claimants will influence claim numbers. An increase in the standard of proof is likely to reduce the number of claims by ineligible claimants but also reduce claims from eligible claimants who are unable or unwilling to produce such proof (R. W. Hansen et al., 1989). Evidence of attribution of work is likely to be particularly difficult for gradual process injury and occupational disease. Scherzer, Rugulies, and Krause (2005) find that 35 percent of hotel workers who filed a claim for work-related pain and discomfort had the claim denied. The study did not discuss the reasons why the claims were denied, but one plausible reason would be insufficient evidence that the pain is attributable to work.

The need for evidence impacts not just on the claim denial rate, but also on beliefs about whether the claim will be accepted, and therefore the likelihood that a worker will make a claim in the first case. Even when a physician has identified that musculoskeletal pain is likely to be work-related, a workers' compensation claim is only made about 25 to 30 percent of the time (Biddle & Roberts, 2003; Rosenman et al., 2000).[2]

[2] Scherzer et al. (2005) find that only 20 percent of unionised hotel cleaners with self-reported work-related pain and discomfort file a workers' compensation claim, and Rosenman et al. (2000) find that 25 percent of individuals diagnosed with work-related pain (mainly unionised autoworkers) file a workers' compensation claim.

3.5.3 They did not think the injury was serious enough.

Severity of injury is frequently identified as an important predictor of claiming behaviour in regression studies. In one such study, Shannon and Lowe (2002) find that workers were more likely to report having made a claim if the injury was serious enough to require two or more of: medical attention; time off work; modified duties. Similarly, Rosenman et al. (2000) find that severity is the strongest predictor as to whether individuals diagnosed with work-related pain filed a workers' compensation claim. Qin, Kurowski, Gore, and Punnett (2014) also find severity to be a significant predictor of claiming among skilled nursing facility workers who experienced work-related back pain. This implies that workers' compensation claims provide more complete surveillance for injuries that are more severe.

Mustard et al. (2012) present further evidence in support of this. They compare work-related injury and illness presenting to Ontario emergency departments to workers' compensation claims. They find that the number of emergency visits is 60 percent higher than the number of claims, but when they restrict analysis to serious injury (those resulting in a fracture or concussion), the incidence is similar between the two datasets.

Related to the idea that the injury was not serious enough to report is the perspective that pain is part of the job. A survey of 135 union members working in the construction industry finds that the top three reasons for not reporting work-related injury are "My injury was small, so I don't need to report it"; "I accept that pain is a natural part of the job"; and "home treatment, anti-inflammatories, pain medication, heat, etc., are sufficient to deal with my problems" (Taylor Moore et al., 2013). Variation in attitudes will lead to variation in injury reporting.

Another source of variation is attitudes to treatment of injuries; this frequently varies by culture. For example Sobrun-Maharaj, Tse, and Hoque (2010) find that some people in Asian communities prefer to self-diagnose or visit a traditional practitioner before they will visit a private general practitioner. If these types of treatments are not covered by workers' compensation, people with these cultural preferences will be less likely to appear in the claims data.

3.5.4 They thought the reporting process was too complicated

Some of the reasons given for not filing a workers' compensation claim include it being too much trouble (Scherzer et al., 2005); workers not knowing that they can claim (Fan, Bonauto, Foley, & Silverstein, 2006); and workers not knowing how to claim (Scherzer et al., 2005). These studies indicate that increased awareness about eligibility for claiming and how to make a claim could reduce underreporting by up to 18 percent.

3.5.5 Fear of how others might react

In a qualitative study of unionised construction workers, three of the top six reasons identified for why some workers do not report work-related injury to their employer are: "I am afraid I will not be hired again by the contractor if I file a workers' compensation claim"; "I'm worried about being labelled as a complainer by my co-workers or supervisors"; and I'm concerned about being teased by co-workers for not being tough enough" (Taylor Moore et al., 2013).[3] These fears are likely to disproportionately affect workers with tenuous job security such as immigrants, low-income workers and those in precarious employment (Azaroff, Levenstein, & Wegman, 2002).

[3] The other three reasons identified were: "I want the safety incentive for no lost work time"; "I accept that injury and pain are a part of the job"; and "the paperwork and process for filing workers' compensation claims is complicated". These reasons are covered under other headings in this section.

Few studies attempt to quantify the extent that the fear of how others might react impacts on claiming behaviour. Fan et al. (2006) estimate that eight percent of workers with a work-related injury or illness do not file a workers' compensation claim for this reason. Similarly Safe Work Australia (2011) find that nine percent of employees did not claim out of concern for the possible impact on current or future employment. Qualitative research by Sobrun-Maharaj et al. (2010) finds that seeking help when in pain may be seen as a sign of weakness in Asian communities in New Zealand, and that not working is also seen as a sign of weakness for males. Further, they find that the main reason given for not seeking assistance is that ACC claims may affect their employment prospects. Although it is illegal in New Zealand, to discriminate against job applicants based on current or previous ACC claims (Human Rights Commission, 2016), this clearly remains a concern for some workers.

In a study of unionised hotel cleaners, Scherzer et al. (2005) find that 26 percent of workers with work-related pain are afraid to claim. Hotel workers may experience less employment security than the general workforce and claims for work-related pain are more difficult to attribute to work than injury, which may generate high levels of uncertainty and fear; however unionised workers tend to be more likely to claim than non-unionised workers (Morse, Punnett, Warren, Dillon, & Warren, 2003), implying that fear of claiming might be even higher for non-unionised hotel cleaners.

These estimates of the size of underreporting in response to fear of how others might react are likely to undercount the extent of the problem as some workers may be unwilling to give it as the reason for not reporting. If they are worried about others' perceptions of them, they may instead give another reason, such as the injury was not serious enough or the injury is just part of the job.

Tied closely to fear of consequences is the organisational safety climate. Safety climate is the extent that an organisation promotes safety in what it says and does. A positive safety climate is likely to address information needs about how to report, as well as reduce fear of reporting. Probst, Brubaker, and Barsotti (2008) find that construction firms with poor safety climate have much higher underreporting of injuries (81%) than those with positive safety climate (47%). Qin et al. (2014) find that skilled nursing facility workers are more likely to claim for back pain if job strain is lower (related to decision-latitude) and social support at work is higher. Both low job strain and high social support are elements of a positive safety climate.

3.5.6 Financial reasons for not claiming

Research indicates that when compensation benefits increase, the number of claims and length of time off work also increases (Benkhalifa, Lanoie, & Ayadi, 2016; Biddle & Roberts, 2003; Bolduc, Fortin, Labrecque, & Lanoie, 2002; Chelius & Kavanaugh, 1988) and, vice versa (Chelius & Kavanaugh, 1988). The two main theories of the drivers when the benefits are lower are (1) workers take greater care to avoid injury and (2) people are less likely to make fraudulent claims. Since fraudulent claims are more likely to be for injuries that are hard to diagnose, Bolduc et al. (2002) test this by checking whether the distribution of easy-to-diagnose relative to hard-to-diagnose injuries changed following a change in benefits. They find that a one percent increase in benefits leads to an increase in the proportion of difficult-to-diagnose injuries of 0.1 to 0.4 percentage points (from a base of 44 percent).

An alternative explanation is that when benefits increase, the advantages of making a claim increase relative to the disadvantages, making claiming more cost effective for injuries that are more difficult to claim for. For example, qualitative research shows that some people would choose to work rather than seeking treatment (and making a claim) if the benefits are lower than the income required to support a family (Sobrun-Maharaj et al., 2010; Taylor Moore et al., 2013).

Sobrun-Maharaj et al. (2010) find that some elderly people in Asian communities would rather pay for themselves because they do not want to be seen as ‘begging’, while Jansen, Bacal, and Crengle (2008) find that some Māori put off visiting the doctor because of the cost. If people do not seek treatment or refuse to complete a claim form, then they will not be represented in the claims data.

3.5.7 Access to health services

People who do not receive treatment for their injury will not appear in the claims data. Some of the reasons for not receiving injury treatment have been discussed above (e.g., the injury is not serious enough, they cannot afford the treatment, or they prefer alternative sources of treatment not covered by the insurance scheme). Additional barriers to treatment may include cost, time availability (e.g., caring for others), geographic distance, waiting times, availability of after-hours treatment, lack of culturally appropriate services, and language differences (J. R. Barnett & Coyle, 1998; R. Barnett, 2000; Bierman & Clancy, 2000; Ellison-Loschmann & Pearce, 2006; Jatrana & Crampton, 2009).

Studies on primary health care utilisation in New Zealand, typically find that gender, age, ethnicity, employment status, deprivation and health status are associated with health care utilisation (Cumming, Stillman, Liang, Poland, & Hannis, 2010; Jatrana & Crampton, 2009). Attitudes to health services and access to treatment will be an important driver of whether an injured person in New Zealand, makes a claim.

3.6 Relative importance of reasons for not claiming

A survey run by the Australian Bureau of Statistics every four years, provides some insight into the relative importance of the above reasons for not claiming (Safe Work Australia, 2011). The top three reasons given in 2009/10 for not making a workers' compensation claim following work-related injury or occupational disease were:

1. They considered the injury to be too minor or required too much effort to claim (62 percent of injured workers who do not claim);
2. They did not think they were covered or did not think they were eligible (14 percent); and
3. They were concerned it would have a negative impact on employment (eight percent).

Even among those who had five or more days off work from injury, a third of those who did not claim stated it was because the injury was minor or claiming required too much effort.

3.7 Characteristics associated with claiming

Characteristics associated with a higher propensity to claim include injury severity (Alamgir, Koehoorn, Ostry, Tompa, & Demers, 2006; Biddle & Roberts, 2003; Qin et al., 2014; Shannon & Lowe, 2002), having a physical job (Biddle & Roberts, 2003; Qin et al., 2014), lower levels of education (Qin et al., 2014), being married (Fan et al., 2006), living in an urban area (Koehoorn et al., 2015), being overweight (Fan et al., 2006), being in poorer health (Biddle & Roberts, 2003) and having comorbidities (J Wren & Mason, 2010). A lot of these characteristics also appear to be related to the extent to which workers can modify their job to continue working following injury.

Findings regarding propensity to claim by different age groups are inconsistent; Biddle and Roberts (2003) find that older workers are more likely to claim while Alamgir et al. (2006) finds that they are less likely to claim. The difference in results may relate to the different populations studied: Biddle and Roberts (2003) sample people identified by physicians as having work-related back and arm pain, while Alamgir et al. (2006) look at a cohort of sawmill workers. It may be that the culture of older sawmill workers is such that they have a lower relative propensity to claim compared to the general population.

3.8 Underreporting in a universal claims environment

The determinants of underreporting in a universal claims environment may differ to that within a workers' compensation scheme. For this reason, New Zealand-specific literature is described in this section.

Urangia (2012) compares work-related serious harm reported to the occupational health and safety regulator to serious harm claims in the ACC work account for the Fruit and Vegetable Wholesale industry in the period 2004 to 2009. Employers are required to notify the regulator of serious harm events under the Health and Safety in Employment Act 1992.[4] The results indicate that only 10 percent of serious harm notifications had an ACC claim, indicating that claims data underestimate serious harm by at least 90 percent. This is a much higher estimate of underreporting than is generally found in the literature (e.g., see section 3.4).

The author suggests some reasons for why many serious harm events do not appear in the ACC claims data: they might fall under an Accredited Employer Programme (where employers manage work claims instead of ACC) and therefore would not be captured in the data used for her study; the serious harm may be an aggravation of an existing health

[4] The Health and Safety in Employment Act 1992 has since been replaced by the Health and Safety at Work Act (2015).

condition which would not be covered by ACC; and the notification may be for an injury too minor to make a claim (leading to lower levels of underreporting of serious harm in the claims data if serious harm were correctly specified). Another likely reason not mentioned by the author would be that some of the serious harm notifications may have been captured in a different claims account. For example, work-related serious harm to people not in paid employment at the time of injury (e.g., clients, volunteers, tourists and road traffic accidents) would have been captured in the serious harm notifications data but not in the ACC work account (these would have been in the non-earners' account or the motor vehicle account).

In a review of claiming behaviour, ACC find that Māori, Pacific and Asian peoples are particularly 'low-claiming' (Accident Compensation Corporation, 2008). For example, Asians represented seven percent of the New Zealand population in 2006 but only two percent in the claims data (Sobrun-Maharaj et al., 2010).

The New Zealand Health Survey shows that people of Asian ethnicity living in New Zealand, are less likely than the full population to have visited a GP, a practice nurse, and after hours in the last 12 months; however, they are also less likely to report unmet need for primary health care and after-hours services and less likely to report unmet need for GP services due to cost. Those of Asian ethnicity have similar rates as the general population for being unable to get an appointment within 24 hours at their usual medical centre in the past 12 months. This implies that the lower claim rates may be related to lower perceived need for treatment rather than barriers to access. Although people of Māori ethnicity visited a GP, practice nurse and after hours at similar rates to the full population, they are more likely to report having unmet need for these services and more likely to have unmet need for GP services due to cost (Ministry of Health, 2012).

The design and implementation of workers' compensation schemes plays a role in the extent to which claims data capture injuries. Insurance coverage, ease of claiming and awareness of entitlements can all impact on whether a person makes a claim. I would expect the complexity of the initial claiming process to be less of an issue in a universal claims environment, at least at the initial point of submitting a claim. Treatment providers are responsible for completing the form and sending it to ACC. This shifts a lot of the effort of claiming from the injured person to the treatment provider.

In 2014/15 ACC accepted 1.8 million new claims – "this equates to 30.5 percent of New Zealanders receiving compensation or rehabilitation services" (Accident Compensation Corporation, 2015a). Despite this, ACC find that 17 percent of the public feel 'not at all informed' about ACC and 80 percent of the public believe 'everyone/all New Zealanders' are entitled to help from ACC when they are injured (Accident Compensation Corporation, 2007). This implies that despite simplified eligibility in New Zealand, awareness of eligibility may still act as a barrier to claiming accident compensation for a minority of people. In some cases, language barriers and cultural differences may prevent some people from making an ACC claim. Sobrun-Maharaj et al. (2010) and DeSouza and Garrett (2005) identify that a lack of information and communication about how to make a claim to be a barrier for Asians in New Zealand, while Jansen et al. (2008) find that Māori have lower levels of trust and satisfaction with ACC relative to other healthcare providers.

3.9 Workers' compensation and misreporting of injury

Scheme incentives designed to improve workplace health and safety by rewarding employers or employees for reductions in reported injury can have the unintended consequence of increasing underreporting. Experience rating, zero harm targets in workplaces, and safety bonuses have all been criticised for their potential to result in unintended consequences (Arthurs & Shepell, 2012; Lamm, McDonnell, & St John, 2012; Wuellner & Bonauto, 2014). While much of the criticism is based on theory and anecdote, there are some quantitative studies that also support this view. For example, Wuellner and Bonauto (2014) use matched workers' compensation claims and establishment survey data to assess underreporting of injury in establishment injury records. They find workplaces that use establishment injury records to measure job performance have higher levels of underreporting. Experience rating has been similarly criticised for incentivising claims management behaviour (Clayton, 2002; Mansfield et al., 2012). The next section reviews the literature on experience rating in more depth.

3.10 Experience rating and claims management

Economic theory predicts that in the absence of workers' compensation schemes, employers will pay a wage differential to employees to compensate for the job's injury risk. Employers are motivated to improve safety in return for paying lower wages. Market mechanisms will result in an efficient equilibrium that balances the costs of safety with the costs of wages (Ruser & Butler, 2010).

In the presence of a workers' compensation scheme that fully compensates workers for injuries, there will not be any compensating wage differentials for injury risk. Instead employers pay a flat workers' compensation levy and employees receive full compensation if they have an injury; however, paying a flat levy reduces the potential benefits to individual employers from investment in injury prevention. To combat this, many compensation schemes add an experience rating component to levies. Experience rating adjusts levies based on a firm's claims history, increasing financial incentives for injury prevention.

Although studies into the effectiveness of experience rating generally find that it reduces the number of claims (Tompa, Cullen, & McLeod, 2012), it is also thought to increase claims management. Claims management may take the form of discouraging employees from reporting accidents, appealing claims, pressuring workers to return to work early, or even falsifying or destroying accident records (Dabee, 2017; Tompa, Trevithick, & McLeod, 2007). In New Zealand's case it could also take the form of claiming work-related claims as occurring outside of work.

A variety of methods have been employed to look at claims management behaviour. Thomason and Pozzebon (2002) (Quebec) and Kralj (1994) (Ontario) survey firms about changes they made in response to the introduction of experience rating. Both studies find that firms use a combination of improvements to health and safety, speedier return-to-work following serious injury, and increased claims management activity to reduce injury claims.

Campolieti and Hyatt (2006) review the introduction of experience rating in British Columbia and find that while some claim types decreased (e.g., health care only and short-term disability claims), the more serious claim types did not; however, in this study they are unable to distinguish between improved health and safety and claims management activity. Tompa, Hogg-Johnson, et al. (2012) address this by looking at the relationship between experience rating and the incidence of claim types thought to be associated with claims management: no-lost-time permanent impairment claims, disputed/denied claims, claim types excluded from experience rating, and claims that reopen after the experience-rating window (when the costs no longer impact directly on the employers' levy). They find that a higher degree of experience rating is positively related to these types of claims. In contrast, they find no evidence of improvements to the permanent injury claim rate - the most serious type of non-fatal claim.

In an independent review of workers' compensation funding in Ontario, Arthurs (2012) concludes that the experience rating scheme generates incentives for illegal claim suppression and that it is inadequately policed.. He recommends that more be done to detect and punish illegal activity and that a controlled experiment be implemented to obtain a more reliable assessment of whether experience rating is effective in preventing injuries, improving return-to-work for injured workers and avoiding claims suppression.

Not all studies find evidence of claims management. Neuhauser, Seabury, and Mendeloff (2013) hypothesise that claims management would be skewed towards more minor injuries and therefore average claim costs would be higher. They find no evidence of a change to average claim costs following the introduction of experience rating for small firms. Moore and Viscusi (1989) and Ruser (1993) find that an increase in workers' compensation benefits, and therefore insurance premium costs for experience rated firms, is associated with fewer fatality claims. They argue that fatality claims are less susceptible to claims management and therefore reflect employer improvements to safety; however not all types of work have a fatality risk, so it is not clear whether these findings would apply to all job types.

3.11 Incentives to over-claim

While some incentives in workers' compensation may work towards discouraging people from making eligible claims there are other incentives that may work in the opposite direction, encouraging people to make fraudulent claims.

It has been observed in several countries that there are more workers' compensation claims for injuries on a Monday than any other day of the week (Brogmus, 2007; Richard J. Butler, Durbin, & Helvacian, 1996; B. Hansen, 2016; Smith, 1990; Wigglesworth, 2006). This is referred to as the "Monday Effect" (Campolieti & Hyatt, 2006; Card & McCall, 1996; Martin-Roman & Moral, 2016). A common hypothesis is that excess Monday claims are the result of people injured off-the-job in the weekend fraudulently claiming that their injuries occurred on-the-job on the Monday to receive workers' compensation benefits that they would otherwise not receive. This is known in the literature as the ‘moral hazard hypothesis’. The worker knows where, when and how the injury occurred, but this is not observed by the insurer.

One of the early studies into this hypothesis was by Smith (1990). He theorised that if people were fraudulently claiming weekend injuries as happening at work on a Monday then: (1) injuries that are easy to conceal and for which treatment can be easily delayed would be overrepresented on a Monday; (2) the injuries would be recorded as occurring earlier in the day on a Monday because people would seek to be treated as soon as they could reasonably do so without arousing suspicion; and (3) that the effect would be stronger on a Tuesday after a public holiday Monday because there had been a longer length of time possible for off-the-job injuries to occur. Using workers’ compensation data for several states in the United States of America (USA) he finds broad support for these theories, although the size of misreporting is quite small – 4% of strains and sprains and 1% of fractures equating to 2% of total compensation costs. These results have been replicated in other jurisdictions (Card & McCall, 1996; Choi, Levitsky, Lloyd, & Stones, 1996).

Card and McCall (1996) test this theory further by looking at whether employees likely to be uninsured are more likely to make claims on a Monday and whether employers are more likely to dispute Monday claims. They find no support for either of these propositions. Like Smith (1990), they find that back injuries and strains are more prevalent on Mondays than other weekdays. They conclude there may be physiological reasons for higher claims on a Monday. Campolieti and Hyatt (2006) also reach this conclusion after comparing the Monday effect in Canada to the US. Unlike the US, medical fees for injuries in Canada are fully funded irrespective of whether they are work-related, reducing incentives to fraudulently claim. They find that the Monday effect persists and is of a similar magnitude to that found in the US. Although these studies are not conclusive, they cast doubt on the suggestion that fraudulent claims of weekend injuries happening at work on a Monday explains the Monday Effect.

Richard J Butler, Kleinman, and Gardner (2014) take a completely different approach. They use data from a single large multi-location national employer. One of the key differences between this study and earlier work is that they have data on all employees, not just those who make a claim. This allows them to look at the likelihood of having an injury on a Monday, relative to other days of the week; rather than relying on comparisons of the distribution of different types of injuries. While they find support for higher likelihood of claims for sprains and strains on a Monday, when they interact the Monday dummy variable with other characteristics thought to be associated with the incentive to make fraudulent claims for weekend injury on a Monday at work (such as whether they have health insurance with the employer, the wage replacement rate, and tenure), none of the interactions are statistically significant. To investigate this further, they obtain descriptive statistics for fatalities, medical insurance claims for sprains and strains (not just work injury) and sick leave data by day of the week. They find fewer fatalities on a Monday, but more strains and sprains and sick leave. This leads the authors to conclude that workers may have an aversion to working on Mondays.

Since then, there have been other studies that claim to find support for the fraudulent claims explanation of the Monday Effect. One such study uses a policy change in the state of California that makes it harder to make fraudulent claims (B. Hansen, 2016). Using a difference-in-differences approach the author finds that sprains and strains on a Monday decreased by seven percentage points in California following the policy change, with no change in other states. The paper does not discuss whether the reforms might be expected to affect legitimate work claims. If the reform also increased the costs of claiming for legitimate work claims (e.g., by increasing the costs associated with proving that the injury was work-related), then the decrease does not necessarily represent a decrease in fraudulent claims.

In a similar study, Martin-Roman and Moral (2016) exploit differences in loss of earnings compensation coverage for on-the-job versus off-the-job injury in Spain. In Spain, work injuries receive higher compensation than off-the-job injury for the first few weeks off work; however, once the person has had more than 20 days off work, both on-the-job and off-the-job injuries receive the same compensation entitlements. They find the Monday effect decreases with time off work, but there is an effect that persists after the 20-day mark. The authors conclude that both fraudulent claiming and a physiological explanation are at play.

Almost all the studies reviewed here assume the distribution of work hours is constant across weekdays. Only two of the studies tested this assumption. Card and McCall (1996) use the work sample from the United States Current Population Survey to look at patterns of work by medical coverage. They find that the probability of being at work on any given weekday is generally constant, apart from low-wage retail workers who have a high probability of being uninsured and a low probability of working on a Monday. Subsequently they exclude retail employees from the analysis but still find a Monday Effect. Other studies assume that the incidence of injury types less susceptible to incentives to fraudulently claim weekend injuries on a Monday at work, such as fractures, is a good control for hours of work. They look at the excess size of sprains and strains relative to fractures; however, injury hazards associated with fractures are different to the hazards associated with sprains and strains so the number of fractures on a Monday may not be a good control for the expected number of strains and sprains.

Brogmus (2007) calculates day of the week rates per number of work hours using Time Use Survey data. The author finds that the rate of Monday lost-time occupational injuries is statistically significantly higher than the injury rate on other weekdays.

Although not directly investigating the Monday effect, Vegso et al. (2007) conduct a case-crossover study looking at the role of hours worked in cases where in an injury occurred, compared to the same day several weeks earlier where an injury did not occur. The data come from a single large multi-site company, and the injury data are sourced from its incident management system. The authors study the period one day, two days, three days and seven days before the injury. Using a conditional logit model, the authors find that the control group was more likely to have not worked in the previous day(s) than the injured group, although the difference was not statistically significant. This hints that a rest period is not associated with higher risk of injury on return to work. Those who worked over 64 hours in the seven days before the injury were statistically significantly more likely to have an injury relative to those who worked 0-40 hours in the week before (hazard ratio 1.88, 95% confidence interval (1.16-3.05)). This implies that working long hours is more likely to be associated with injuries than is a rest period, providing some evidence against the ergonomic theory.

The countries in which these studies have been done either require private health insurance to receive cover for off-the-job injuries (e.g., the United States of America) or they have a public health care system that covers medical fees for off-the-job injury but do not provide benefits for loss of income (e.g., Canada, Australia). This creates incentives to claim off-the-job as occurring on-the-job to receive workers' compensation entitlements. New Zealand has a universal accident compensation scheme in which injuries receive the same compensation cover (both medical costs and loss of income benefits) whether the injury occurs on-the-job or not. This reduces incentives to fraudulently claim off-the-job injury from the weekend as happening at work on the Monday compared with other countries. This aspect will be studied in detail in chapter 8.

3.12 Summary

The literature suggests that there are seven primary reasons why people might not make an accident compensation claim following injury: they may be ineligible for compensation; they do not think the injury is serious enough; they are not sure if it is work-related; the reporting process is too complicated; fear of how others might react; financial reasons; and because they did not get the injury treated.

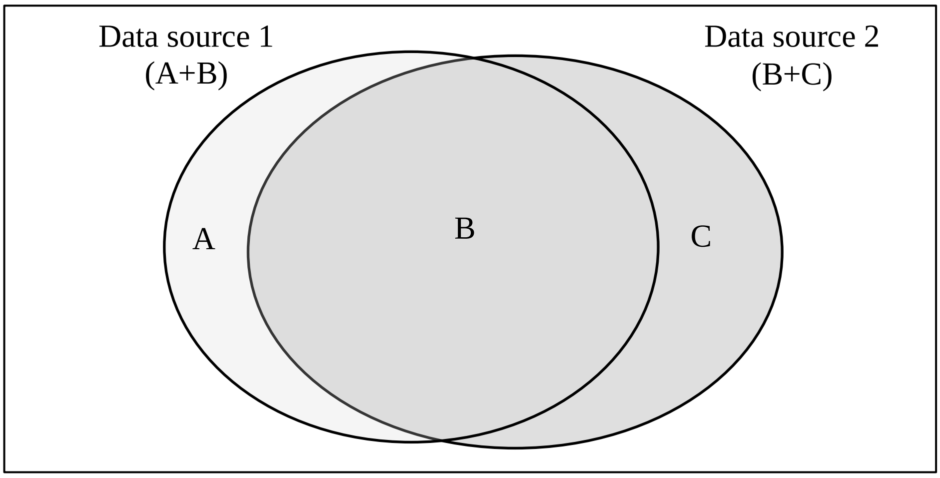
This literature review has focused on misreporting within workers' compensation claims data. There is a separate literature, not covered here, on underreporting in data captured by health and safety regulators (Wergeland, Gjertsen, & Lund, 2009; Wuellner & Bonauto, 2014) and within workplaces (Pransky, Snyder, Dembe, & Himmelstein, 1999), and in healthcare data (Sears, Bowman, Hogg-Johnson, & Shorter, 2014).

Spieler and Burton (2012) suggest that removing the need for proof that injury is work-related could improve access to compensation for schemes in other countries. In chapter 6 I look at whether underreporting in the universal scheme in New Zealand, is lower than that found elsewhere and characteristics associated with having a claim[5]. I look at whether experience rating is associated with claims shifting from work injury to off-the-job injury in chapter 7 and in chapter 8 I look at whether the "Monday Effect" is present in New Zealand, given that on- and off-the-job injury is covered by the same entitlements.

[5] I am not able to directly measure whether any differences in underreporting are caused by differences in the work-relatedness requirement or other differences such as access to treatment; however, I believe the question of whether there is a difference remains an interesting one.

3.13 Figures and Tables

Figure 3.1: Using two data sources to estimate a lower bound for misreporting of injury



Note: In this example, misreporting of injury is assumed to consist of the gap in reporting between data source 1 and data source 2 (A+C)

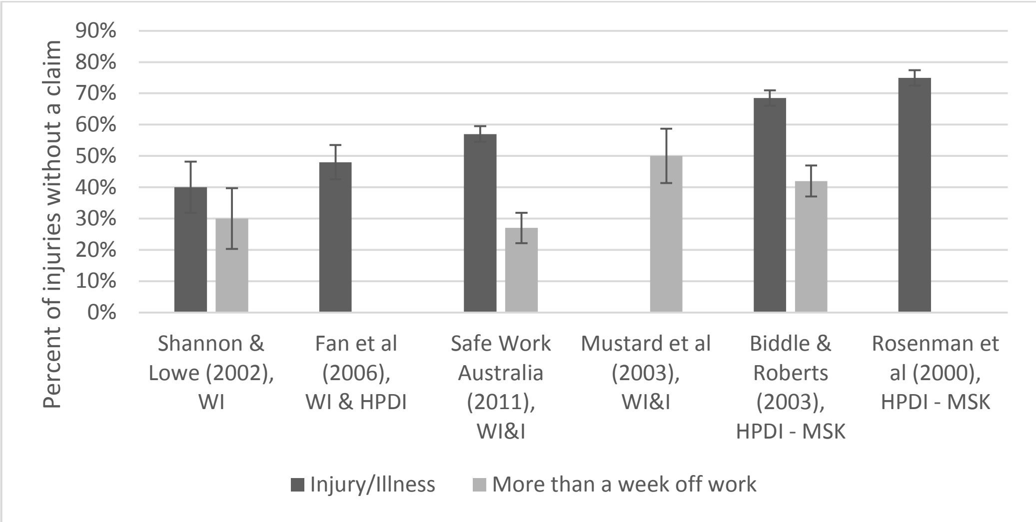
Figure 3.2: Possible sources of data on injuries, according to severity of injury

	No injury	Mild	Moderate	Severe	Fatal
Household (community) surveys					
Health clinic records					
Family doctors' records					
Emergency room records					
Ward admission records					
ICU* admission records					
Death Certificates					

* ICU=Intensive Care Unit

Source: (Holder et al., 2001)

Figure 3.3: Proportion of workers with a work-related injury or illness who do not make a workers' compensation claim



Note: Error bars are 95% confidence intervals.
WI = Work-related Injury;
HPDI = Health Professional Diagnosed Illness;
WI&I=Work-related injury or illness;
MSK = Musculoskeletal gradual process injury

Chapter 4

Economic Theory

This chapter outlines a theoretical model of incentives in a universal claims environment. It starts with the workers' compensation environment and then considers how incentives vary under universal accident compensation.

4.1 Worker incentives

Ruser and Butler (2010) economic theory of workers' incentives under workers' compensation. Consider a single period. At the start of the period the worker decides how much effort, e, to put into avoiding an injury, given wage W and workers' compensation B. An injury occurs with probability p. If the injury occurs, then the worker is off work and receives a benefit B. If the injury does not occur (with probability $1 - p$) then the worker receives wage W.

The likelihood of an injury is:

$$\text{injury probability} = p(e) \text{ where } \frac{dp}{de} < 0, \frac{d^2p}{de^2} > 0, \tag{4.1}$$

where the worker's safety efforts are subject to diminishing returns.

The cost of effort to prevent the injury is given as:

$$\text{Utility equivalent costs} = c_e(e); \ \frac{dc_e}{de} > 0, \frac{d^2c_e}{de^2} > 0 \tag{4.2}$$

The payout at the end of the period depends on whether a work injury occurs and how the worker responds to the injury. I introduce a treatment decision option into the model from Ruser and Butler (2010). I consider three possible responses:

1. The worker obtains treatment for the injury and makes a workers' compensation claim.
2. The worker does not have the injury treated and continues to work.
3. The worker obtains treatment for the injury but does not make a workers' compensation claim.

The worker obtains treatment and makes a workers' compensation claim

Obtaining treatment requires effort, h. This effort includes costs not covered by compensation such as travelling to a medical practitioner and making alternative care arrangements for dependents.

$$\text{Utility equivalent costs} = c_h(h);\ \frac{\delta c_h}{\delta h} > 0, \frac{\delta^2 c_h}{\delta h^2} > 0 \tag{4.3}$$

For simplicity, I assume that there are no costs associated with submitting a workers' compensation claim, other than the requirement that the injury is treated and that there is proof that the injury was work-related. Workers choose how much effort f, to put into proving that the injury was work-related.

$$\text{Utility equivalent costs} = c_f(f);\ \frac{\delta c_f}{\delta f} > 0, \frac{\delta^2 c_f}{\delta f^2} > 0 \tag{4.4}$$

I assume diminishing returns to effort. There are several different things workers can do to accomplish each, and they first do those that are most effective per unit of effort exerted.

The expected utility of an injured worker who has an accepted claim is:

$$\mathrm{u}(\text{claim}|\text{work injury}) = u(B) - c_h(h) - c_f(f) \tag{4.5}$$

where $u(.)$ is the utility of receiving compensation benefits, B. For simplicity, I assume all workers' compensation injuries receive time off work, and B captures loss of earnings compensation and medical treatment compensation.

Under accident compensation, all injuries are covered by the scheme, irrespective of whether the injury occurred at work. I assume that under accident compensation $f = 0$, while under workers' compensation $f > 0$. Holding everything else constant, the utility from making a claim will be higher under accident compensation than under workers' compensation.

Hypothesis 1: There will be a lower proportion of injured workers who do not make a claim under accident compensation relative to workers' compensation, because there is no requirement to prove that the injury occurred at work.

The worker does not have the injury treated and continues to work

If the worker decides not to get treatment, he or she will continue to work and receive wage W and disutility from working ξ, but have disutility associated with living with an untreated injury n. The size of n depends on the type of the injury, its seriousness, and the worker's belief about the effectiveness of health care. I assume that, $W \geq B$.

Although n is a constant here, an extension would be to have it vary in size by the seriousness of the injury, as is done in Krueger 1990. For some injuries, it could take such a high value that continuing to work is not an option.

$$\mathrm{u(no\ claim|work\ injury)} = \mathrm{u(W)} - n - \xi \tag{4.6}$$

An injured worker will choose to be treated and to make a claim over not being treated if:

$$u(B) - c_h(h) - c_f(f) > u(W) - n - \xi \tag{4.7}$$

Hypothesis 2: This inequality is more likely to hold if:

- Workers compensation benefits increase relative to wages.
- The effort required to obtain treatment decreases.
- The effort required to prove that an injury is work-related decreases.
- Disutility from working increases.
- The disutility from living with an untreated injury increases.

The worker obtains treatment for the injury but does not make a workers' compensation claim.

If a worker is injured during leisure time, for example at home or playing sport, he or she is not covered under workers' compensation. However, some of the costs may be covered by state provided disability insurance, D. I assume that $W \geq B > D$.

$$\text{u(treatment|leisure injury)} = u(D) - c_h(h) \tag{4.8}$$

Work injury versus leisure injury

I assume that it is not observable to the treatment provider and employer whether the injury happened at work. The likelihood that a treatment provider believes that the injury is work-related, γ, depends on effort, f.

$$u(treatment|work\ injury) = \gamma(f)u(B) + \big(1-\gamma(f)\big)u(D) - c_h(h) - c_f(f) \tag{4.9}$$

The worker chooses e and f to maximise expected utility:

$E\mathrm{U}(\mathrm{e},\mathrm{f}) =$

$$\begin{cases} \big(1-p(e)\big)[u(W)-\xi] + p(e)\big[\gamma(f)u(B) + \big(1-\gamma(f)\big)u(D) - c_h(h) - c_f(f)\big] - c_e(e) & \text{if claims} \\ u(W) - \xi - p(e)n - c_e(e) & \text{if not treated} \\ \big(1-p(e)\big)[u(W)-\xi] + p(e)[u(D) - c_h(h)] - c_e(e) & \text{if treated but no claim} \end{cases}$$

(4.10)

Hypothesis 3: Injured workers who face high costs associated with treatment effort will be less likely to seek treatment and therefore less likely to claim than those with low costs associated with treatment effort.

In the case of universal accident compensation, leisure injury is covered by the insurance scheme. If under accident compensation, $B = D$, $f = 0$ and $\gamma = 0$, there will be no incentives to pretend that a work injury occurred during leisure activity (or that a leisure injury occurred at work).

$$EU(\mathrm{e}) = \begin{cases} \big(1-p(e)\big)[u(W)-\xi]+p(e)[u(B)-c_h(h)]-c_e(e) & \text{if claims} \\ u(W)-\xi-p(e)n-c_e(e) & \text{if not treated} \end{cases} \tag{4.11}$$

4.2 Non-earner incentives

Non-earners are not eligible for compensation under a workers' compensation system; however, they are eligible under accident compensation. Non-earners have some alternative source of income S, which is not affected by whether they are injured (e.g. unemployment insurance, wages from their spouse, savings). If a non-earner is injured, there is no wage compensation for time off work because the non-earner is not in paid employment; but the injured person will be covered for treatment costs.

The non-earner chooses injury prevention effort, e, to maximise utility. The non-earner influences claim numbers based on whether the cost of effort to obtain treatment is greater than the cost of remaining untreated.

$$EU(e,h) = \begin{cases} u(S)-p(e)[u(B)-c_h(h)]-c_e(e) & \text{if treated} \\ u(S)-p(e)c(n)-c_e(e) & \text{if not treated} \end{cases} \tag{4.12}$$

Hypothesis 4: Injured non-earners who face high costs associated with treatment effort will be less likely to seek treatment and therefore less likely to claim than those with low costs associated with treatment effort.

4.3 Employer incentives

I use the model of employer incentives in workers' compensation from Ruser and Butler (2010).

Employers pay a levy for workers' compensation insurance. The levy they pay is a weighted average of the company's own payout costs (weighted by α) and the costs of companies in the same levy risk group (weighted by $1-\alpha$). If a company is fully self-insured, then $\alpha = 1$ and the levies paid will be equal to the company's compensated costs. If a company is covered under workers compensation, then $\alpha = 0$ and the levy costs will be a fraction of the total compensation costs. If the company is experience-rated, then $0 < \alpha < 1$.

The firm faces compensation costs, B. However, a firm can influence the proportion of accepted claims Π through effort t, for example, by disputing claims or rewarding teams that have no injuries. Under accident compensation, this could also take the form of encouraging workers to state that the injury happened during leisure time rather than at work.

The compensated costs for the firm are $\Pi(t)B$. The firm's effort is subject to diminishing returns so that $\frac{\delta\Pi}{\delta t} < 0$ and $\frac{\delta^2\Pi}{\delta t^2} > 0$.

$P(s)$ is the fraction of the workforce with an injury, this can be influenced by the firm through safety effort s, subject to diminishing returns $\frac{\delta \mathrm{P}}{\delta s} < 0$ and $\frac{\delta^2 \mathrm{P}}{\delta s^2} > 0$.

The model of workers' compensation payments by the firm is:

$$\text{Levy} = \alpha P(s)N[\Pi(t)B] + (1-\alpha)FN \tag{4.13}$$

where N is the size of the workforce and F is the per worker levy rate for the firm's levy risk group. When $\alpha = 0$ the levy is not influenced by s or t. However, as $\alpha \rightarrow 1$, an increase in s and t will decrease the levy amount.

Hypothesis 5: Where experience rating is present, ($\alpha > 0$), firms will increase safety effort and increase claims management.

The firm maximises profits with respect to safety, s, and claims management, t with associated costs of effort $Z(s,t)$ where $\frac{\delta Z}{\delta j} > 0, \frac{\delta^2 Z}{\delta j^2} > 0 \; for \; j = s, t.$

$$Profits(s,t) = g\Big(\big(1 - P(s)\big)\mathrm{N}\Big) - W\big(1 - P(s)\big) - \alpha P(s)N[\Pi(t)B] - (1-\alpha)FN - Z(s,t) \tag{4.14}$$

Where $g(.)$ is a concave production function, assuming the only input influenced by safety is labour, and the firm's product price has been normalised to 1.

Chapter 5

Data

The data used for this research comes from the Integrated Data Infrastructure (IDI), a linked longitudinal dataset managed by Statistics New Zealand. The IDI is made up of a series of datasets from different source agencies that have been integrated using deterministic and probabilistic linking (see Figure 5.1). Most of the data sources are administrative and cover the full population, not just a sample. The IDI contains information about employees, employers, ACC claims and self-reported injury, making it a powerful dataset to study work-related injury. The main structure of the IDI - the spine - is based on three linked data sources: IRD numbers issued by Inland Revenue, births registered in New Zealand since 1920, and all visas granted to migrants from 1997 (excluding visitor and transit visas). People present in at least one of these three data sources are included in the spine (Gibb, Bycroft, & Matheson-Dunning, 2016). The nature of the IDI means that the research is focused on New Zealand workers and residents. Tourists are not included in the spine and are therefore excluded from this research.

5.1 How the IDI is used

This research uses IDI data from ACC (injury claims), the Statistics New Zealand Survey of Family, Income and Employment (SoFIE) (self-reported injury), the Inland Revenue Department (linked employer-employee data) and the Ministry of Health (hospitalisation data)[6]. A summary of how these data sources are used in the research follows, with each of these data sources described in more detail below.

The linked data on injury claims from ACC and self-reported injury information from SoFIE are used to assess the level of underreporting in claims data (when used for injury surveillance) in chapter 6. Information on the characteristics associated with having a claim primarily comes from the SoFIE data; however, I include linked hospitalisation data from the Ministry of Health as a proxy for the severity of injury.

In chapter 7, I use the linked employer-employee data from IRD to create firm-level claims by linking claims to employees and employees to firms. I also use information from the IRD data to derive information relevant to experience ratings such as an estimate of liable earnings and ACC insurance premiums (levies). A range of information from the IDI, such as firm size, industry and employee characteristics is used as controls in this work. Unlike studies that rely purely on claims data, I use a richer set of controls for firm and worker characteristics through the information in the IDI (e.g., percent of young workers, worker turnover, and whether the firm is part of a larger enterprise).

Chapter 8 primarily uses claims data, although this is supplemented with more complete information on age, gender and ethnicity from the IDI. This information is derived by Statistics New Zealand from the many data sources in the IDI where this information is captured.

[6] Access to the IDI is available to New Zealand-based researchers conducting research that is in the public interest. Research applications are managed by Statistics New Zealand and, where approved, data access is provided through a secure Data Lab. Researchers only receive access to the data needed for the specific research project. Access to the Business Register data is restricted to government researchers. The research output goes through a confidentiality checking process before being approved for public release to ensure that the rules contained in the Statistics New Zealand Microdata Output Guide have been correctly applied.

5.2 Accident Compensation Claims

When a person has an injury, an ACC claim form is completed at their first visit to a treatment provider (see Appendix A.1). The form collects information from both the patient and the treatment provider about the accident, whether it occurred at work, employment details, personal details, diagnosis, and what effect the injury has on ability to work. These claim forms are sent to ACC by the treatment provider and entered into the ACC system. ACC gives a unique claim number to every claim recorded and assesses the eligibility of the claim.

Firms in the Accredited Employer Programme are responsible for managing their own claims. They usually have a third-party claim manager that does this on their behalf. The claims are either sent directly to the claim manager by the treatment provider (if the employee is aware of the arrangement), or the treatment provider sends the claim to ACC and ACC passes it on to the claim manager.[7] The AEP employers (or their claims manager on their behalf) provide ACC with regular information about the accepted claims that they manage. These claims are included in the IDI data with an indicator which identifies them as AEP claims.

The data studied here include only those claims accepted for compensation by ACC. The claim is never closed, so the client may obtain further treatment for a single injury event under the same claim number at any stage (Statistics New Zealand, 2015).

Sometimes there may be multiple claims for the same injury, each with a different claim ID. I am interested in the number of injury incidents, rather than the number of claims but there is no unique accident ID. I manage this by assuming that if an individual has multiple claims for an accident that occurred on the same day then it is the same

[7] Within the ACC system these claims are marked as declined.

incident. On advice from an ACC staff member, the claim with the highest amount of compensation paid-to-date is kept. This reduces the number of claims by 0.7 percent.

The claims data used here are for the period April 2001 to March 2015. There are just over 23 million claims, an average of 1.5 million per year. Most of these are minor injuries, with only 62,000 per year involving loss of earnings compensation for more than a week off work.

Gradual process claims are excluded (0.43% of all claims). Of the remaining claims, 93 percent link to the IDI spine. Claims that do not link include those for visitors who are not in the IDI spine but are eligible for accident compensation if they have an injury while in New Zealand.

5.3 Survey of Family, Income and Employment

Chapter 6 uses self-reported injury data from SoFIE, a longitudinal survey run by Statistics New Zealand from October 2002 to September 2010. The target population is the usually resident population of New Zealand living in permanent dwellings. At wave one, 15,100 households were randomly selected to take part. Survey responses were obtained through face-to-face interviews with 22,200 eligible adults and 7,500 children (under 15 years) living in 11,500 households (a response rate of 81 percent). The survey was repeated annually (Statistics New Zealand, 2011).

Every two years (waves three, five and seven) adult respondents were asked a series of health questions. The data from these three waves are used in this research. The retention rate was reasonably high. Of all those surveyed during wave one, 85 percent responded for wave three, 80 percent for wave five and 74 percent for wave seven.

There was a total of 52,281 eligible and responding adults for the health module across the three waves (an average of 17,432 per wave). Almost everyone links to the IDI spine

(98 percent). I exclude 102 responses because they did not respond to the injury question, leaving me with a total sample size of 51,147.

The injury question used in this research is “In the last 12 months, have you had an injury that stopped you from doing your usual activities for more than a week? An injury includes burns, near drownings, and poisoning.” In this thesis I refer to this as ‘limiting injury’.

‘Usual activities’ is likely to include paid and unpaid work and recreational activities. This is a broader question than those usually used in overseas surveys of work-related injury, which tend to ask about injuries that stopped the person from working (lost-time injury).

There are two follow-up questions that ask about where the injury occurred (at home, at work, somewhere else) and what type of injury it was (sports injury, traffic injury, other injury). No other information is collected about the injury.

5.4 Inland Revenue

The IDI contains monthly Inland Revenue data from April 1999 onwards. This information is used to derive firm-level variables.

5.4.1 Number of employees

Information matching employees to enterprises is derived from the Linked Employer Employee Data (LEED). LEED links employee tax numbers to employer tax numbers through the Employer Monthly Schedule (EMS) and groups them up to the enterprise level through the Business Register (Fabling & Maré, 2015). I aggregate the monthly data to financial years ending March, averaging the number of employees from the Business Register.

5.4.2 Experience rating information

Experience rating programme data are not included in the IDI, so I have derived some of the relevant variables for firms, such as liable earnings, levies and rating factors, from the Inland Revenue EMS. This is described in more detail in section 7.4.

5.4.3 Linking ACC claims to firms

The person ID (snz_uid) is used to link the claims data to the employee data, which is then aggregated to the geographic unit of the firm (permanent business number or PBN) and the enterprise level (based on enterprise number). Where a person works for more than one firm in a month the claim is evenly apportioned across the firms.

5.5 Ministry of Health

Chapter 6 includes a variable for whether a person has been admitted to hospital in the last 12 months. This is sourced from the Ministry of Health's National Minimum Dataset for SoFIE respondents.

5.6 IDI tables

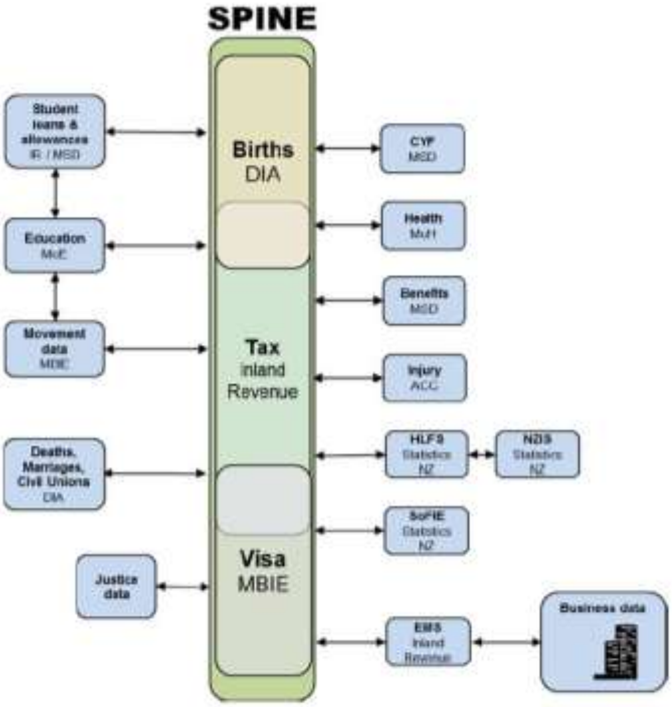
In chapter 6 I use self-reported age, gender and ethnicity from SoFIE because the study is based on the SoFIE sample population. I am unable to use these data in chapter 7 and 8 because I am interested the full population of workers. Instead I use the IDI personal details table and the IDI source-ranked ethnicity table for these two chapters.

The personal details table is Statistics New Zealand's best estimate of demographic information using multiple sources within the IDI. I use this table for age and gender. The source-ranked ethnicity table is based on a Statistics New Zealand ranking of the reliability of each of the collections that contain ethnicity data. The information in these tables is thought to be more robust than that contained in the claims data alone because they are supplemented by other data sources (such as census data) where available.

A single and combined response approach is used where all ethnicities from the highest ranked source are included. For example, if the person reports in the 2013 Census (the highest ranked data source in the IDI) that they are New Zealand European and Māori then their ethnicity is coded as “New Zealand European and Māori”.

5.7 Tables and Figures

Figure 5.1: Structure of the Integrated Data Infrastructure in May 2015



Source: Gibb et al. (2016)

Chapter 6

Who claims for injury? Analysis of self-reported injury compared to accident compensation claims

6.1 Introduction

Workers' compensation claims are often used to analyse the incidence of work-related injury and target resources for injury prevention; however, as discussed in the literature review, not everyone who has an injury receives injury compensation. Claims data are known to underestimate the incidence of injury at work by about a third (Mustard et al., 2003; Safe Work Australia, 2011; Shannon & Lowe, 2002).

As described in the theory in chapter 4, workers can influence claim numbers through their decision as to whether to get treatment for their injury and, if they do obtain treatment, whether to make a claim. Under hypothesis 2, workers will be more likely to be treated and make a claim if workers compensation benefits increase relative to wages, the effort required to obtain treatment decreases, the effort required to prove than injury is work-related decrease, disutility from working increases, or if the disutility of living from an untreated injury increases (e.g. high injury severity).

In the literature, propensity to claim for a work injury has been found to vary according to perceptions around eligibility for compensation (Biddle & Roberts, 2003; McLaren & Baldwin, 2017; Mustard et al., 2012; Safe Work Australia, 2011); the seriousness of the injury (Mustard et al., 2012; Qin et al., 2014; Rosenman et al., 2000; Safe Work Australia, 2011; Shannon & Lowe, 2002); ease of claiming (Fan et al., 2006; Scherzer et al., 2005); perception as to how others might react (Fan et al., 2006; Safe Work Australia, 2011; Taylor Moore et al., 2013); financial considerations (Chelius &

Kavanaugh, 1988; Sobrun-Maharaj et al., 2010; Taylor Moore et al., 2013); and access to health services (Bierman & Clancy, 2000; Jatrana & Crampton, 2009).

Characteristics associated with higher propensity to claim include injury severity (Alamgir et al., 2006; Biddle & Roberts, 2003; Qin et al., 2014; Shannon & Lowe, 2002), having a physical job (Biddle & Roberts, 2003; Qin et al., 2014), lower levels of education (Qin et al., 2014), being married (Fan et al., 2006), being overweight (Fan et al., 2006), being in poorer health (Biddle & Roberts, 2003) and having comorbidities (J Wren & Mason, 2010). There are mixed results for the relationship between propensity to claim and age (Alamgir et al., 2006; Biddle & Roberts, 2003).

The literature on propensity to claim is based on studies within a workers' compensation claims environment. The claims process could be simpler in a universal claims environment where treatment providers submit the claims rather than the workers and the requirement for proof that an injury is work-related is alleviated. This reduces the cost of effort associated with making a claim.

This chapter uses linked data on self-reported injury and ACC claims to test whether underreporting of work injury is lower in New Zealand, relative to other countries and to look at characteristics associated with claiming. Greater clarity of eligibility and lower burden of proof are expected to lead to lower levels of underreporting, making New Zealand claims data more reliable for measuring injury incidence.

6.2 Empirical strategy

I use self-reported injury data from SoFIE and linked ACC claims data to look at what proportion of people who report having had a limiting injury in the last 12 months also have an accepted ACC claim for an injury in the same period. While it would have been of interest to look at declined claims also, these data were not available at the time that this research was done.

A limiting injury is defined as an injury that prevented the person from doing their usual activities for more than a week. This is a different type of injury to that typically studied in the workers' compensation literature, which tend to focus on injuries involving more than a week away from work. The advantage of this type of question is that it can be used to look at compensation outcomes for workers and non-workers alike. The disadvantage is that it is not be directly comparable to estimates from other jurisdictions.

This thesis looks at whether people who report in SoFIE that they had a limiting injury in the last 12 months also have an accepted claim in the same 12-month period. Unfortunately, there is not enough information collected in SoFIE for me to identify whether a claim corresponds to the same injury that was reported in SoFIE. The absence of a claim in the data could indicate that (1) they did not lodge a claim for the injury; (2) they lodged a claim, but it was not accepted (e.g., if the injury was deemed to be a result of the ageing process rather than an accident event); or (3) they thought the injury occurred within the last 12 months, but it was actually more than 12 months ago (recall bias). I am not able to distinguish between the first two reasons, although I test how the results vary if the claims period is extended as a check for recall bias.

I restrict the sample to people with a limiting injury and use linear regression to estimate the effects of demographic, socioeconomic and health variables (described below) on the likelihood of having an accepted claim for an injury that occurred in the last 12 months.

The regression takes the form:

$$Y = \beta X + \varepsilon \tag{6.1}$$

where Y is a binary variable that equals one if the person with a limiting injury (according to SoFIE) also has an accepted claim for an injury that occurred in the last 12 months and zero otherwise, X is a vector of demographic, economic and health variables and ε is a random term.

I use a linear probability model to estimate this binary outcome model because the results lend themselves to easy interpretation and the use of this model is appropriate as most of the explanatory variables are binary variables. The regression is run on unweighted data. It controls for demographic variables often used in survey stratification, so it should provide unbiased estimates of the association between the explanatory variables and the outcome variable.

The demographic variables are gender, age, ethnicity, an indicator for whether the person is born in New Zealand, and a four-category indicator which provides information on the degree of urbanisation in the area that the person lives. Under hypothesis 3, injured workers who face high costs associated with treatment effort will be less likely to seek treatment and therefore less likely to claim than those with low costs associated with treatment effort. Those living in more remote areas are expected to face higher costs associated with treatment effort and a lower likelihood of having a claim.

Ethnicity is coded using the single and combined response method. For example, if someone reports being of both Māori and European ethnicity they are coded to ‘Māori and European’ as opposed to the prioritised ethnicity approach where they would be coded to ‘Māori’. Where numbers are small they are grouped into an ‘other ethnicity/ethnicities’ category. All these variables are based on self-reported information from SoFIE. Some ethnic groups may face cultural barriers to treatment, increasing the costs of effort associated with treatment.

The economic variables are highest qualification, employment status, occupation, annual household earnings, weekly hours worked and the size of the firm for which the person works. Firm size is derived from the tax data, the rest of these variables come from SoFIE. I expect that the coefficient on earnings will be positive indicating better access to healthcare and injury compensation with higher levels of income (J. R. Barnett & Coyle, 1998), while the coefficient on those who work more than 60 hours per week is expected to be negative, owing to the cost of time associated with obtaining treatment.

The health variables are whether the person put off visiting the doctor in the last 12 months because of the cost, the likelihood that they would see their primary health care provider if they had a new health problem, whether they consider themselves to be as healthy as others, whether they have had more than one limiting injury in the past 12 months, and whether they have been admitted to hospital in the last 12 months. The hospital information is derived from Ministry of Health data, the rest of these variables come from SoFIE.

The first two health variables proxy for people's propensity to seek treatment from an approved provider. I expect the coefficient on these to be negative because if people do not seek treatment for their injury then they will not be eligible for accident compensation. People in poorer health may be less able to obtain treatment for injury due to higher non-monetary costs; however, they may also be more likely to obtain treatment due to familiarity with the health system. Therefore, it is an empirical question as to what the direction of the coefficient is on this variable. I expect that people who have had multiple limiting injuries would have an increased likelihood of having had at least one ACC claim, and similarly the coefficient for people who have been admitted to hospital in the last 12 months is expected to be positive. This is partly because it indicates receiving treatment and partly because it indicates that the person had an injury serious enough to require hospital admission.

6.3 Measurement error in claims data relative to self-reported injury

Pooling three waves of SoFIE sample data, there are 52,296 respondents. Of these, 52,281 meet the eligible and responding criteria, of which 52,149 are linked to the IDI spine (98%). I further restrict the sample to those who responded to the question that asks whether they have had a limiting injury in the last 12 months. The final pooled sample size is 51,147, representing an average population of 2.84 million per wave (see Table 6.1).[8]

About 12 percent of people reported in SoFIE that they had experienced a limiting injury in the last 12 months (an injury that stopped them from doing their usual activities for more than a week), while 28 percent of people had an accepted ACC claim for an injury that occurred over the same period. It makes sense that claim numbers are higher than limiting injury numbers because claims can be made for non-limiting injuries. Looking at more serious injury, only 3 percent of the sample had an entitlement claim in the last 12 months.[9] Although Table 6.1 pools data for the three survey waves, the patterns are consistent across individual waves.

Of workers who had a limiting injury at work in the last 12 months, 30 percent did not have an accepted ACC claim in the same period. This is surprisingly high, although consistent with estimates from other jurisdictions for work injuries with more than a week off work (Mustard et al., 2003; Safe Work Australia, 2011; Shannon & Lowe, 2002). Of all people with a limiting injury (work and non-work), a similar proportion (32 percent) did not have an ACC claim. This implies that the reasons for underreporting are not

[8] Estimated using the longitudinal weights.
[9] Entitlement claims are those that have progressed beyond a medical fee only claim. They may involve weekly compensation payments for more than a week away from work, rehabilitation payments and lump sum payments.

limited to workplace injury. This provides some support for hypotheses 3 and 4 in chapter 4; that both workers and non-earners will be less likely to claim if the costs of treatment effort are high.

Recall bias in the response to the SoFIE question may generate misalignment in timing between the two datasets. When the claims period is extended from 12 to 24 months before the SoFIE interview, the proportion that does not have a claim reduces from 32 percent to 18 percent. This is still a sizeable number of people who do not have a claim.

I also look at whether people have ever made an ACC claim. I find that only seven percent of person-wave observations with a limiting injury had no ACC claim between the start of the claims data in the IDI (1994) and the interview date.[10] This makes it likely that most of the reasons for not making a claim are time-varying.

It is likely that different people interpret the SoFIE injury question differently. For some people, an injury that stops usual activities for more than a week may be a relatively minor injury that does not require treatment, such as a cut or sprain. Unfortunately, the survey does not ask any direct questions about the seriousness of the injury, whether it led to time off work or what treatment was received. It is possible that traffic accident injuries are more serious than other types of injuries and when I restrict the data to injuries on the road I find a slightly lower proportion of non-claiming; however, the differences are not statistically significant. Of those with limiting injury on the road in the last 12 months 26% did not receive compensation compared to 32% for all limiting injury (95% CIs [20.3%, 31.7%] and [30.9%, 33.1%] respectively).

Another way to look at the seriousness of limiting injury is to look at the characteristics of the ACC claim, where one was made (see Table 6.1). Most people with

[10] This compares to 18 percent of person-wave observations who had not had a limiting injury in the last 12 months.

a limiting injury who had an ACC claim received medical fees compensation only (rather than entitlement payments), implying that the injury that stopped them from doing usual activities for more than a week was not severe enough to stop them from working or from managing at home. Entitlement payments provide compensation for costs other than treatment, such as loss of earnings compensation (for more than a week off work) and help managing at home (e.g., housework, childcare, personal care). Eligibility for entitlement payments is assessed by ACC based on the recommendations of health professionals.

6.4 Injury at work

SoFIE respondents who had a limiting injury in the last 12 months are asked whether the most recent limiting injury occurred at work. Table 6.2 compares these injuries to claims made in the ACC Work Account. This is of interest because work account claims are often used as a proxy for injury at work. The information about ACC claims by funding account is imprecise because I do not know for certain which claims made in the last 12 months correspond with the limiting injury reported in the survey. For analysing the claims by funding account, I assign the claim to the work account if the person has had one or more work account claim in the last 12 months. If not, I display the funding account of the most recent claim. This allows me to test whether someone who had a work injury in the last 12 months was also able to access compensation for a work injury over the same period.

For those with a limiting injury at work who had an ACC claim, about three quarters were funded from the work account (72 percent). Some of the reasons for a non-work-account claim might include a mismatch between survey injury and claims injury (for people who did not make a claim for the work injury but had made claims for other non-work injuries); it may be a work-related motor vehicle accident which would be funded by the motor vehicle account; the injured person may be working in informal work arrangements, meaning their claim would come under the non-earners' account; they may be at work but the injury was not work-related so it is funded from the earners' account; and people may engage in claims shifting (stating on the ACC form that the injury happened at home when it actually happened at work). I am not able to distinguish between these here. Of all the workers who had made a work account claim in the previous 12 months, only 21 percent reported having had a limiting injury at work implying that most of the work injuries were not limiting.

6.5 Characteristics of people with a limiting injury

Table 6.3 describes the characteristics of people with a limiting injury and the proportion who had an ACC claim. The characteristic with the greatest variability in reporting rates was ethnicity: 69 percent of New Zealand Europeans with a limiting injury made a claim compared to 47 percent of those with Chinese ethnicity.

6.6 Regression results

6.6.1 Characteristics associated with having an accepted injury claim in the same year as a limiting injury

I limit the sample to those who reported in SoFIE that they had a limiting injury and use a linear probability regression to assess likelihood of making a claim. Robust standard errors are calculated to correct for correlated person-clusters. The results are presented in Table 6.4.

Ethnicity is strongly related to the likelihood of making an ACC claim (given that a limiting injury was reported in SoFIE) although the size of the variation decreased once health variables were included. In the final specification, of those reporting a limiting injury, people of Chinese ethnicity are 29 percentage points less likely to have an accepted ACC claim relative to New Zealand European, Māori are 12 percentage points less likely to have an accepted ACC claim and ‘other ethnicities’ are 10 percentage points less likely to have an accepted ACC claim.

The coefficient on age is negative. A ten-year increase in age is associated with a decreased likelihood of having a claim by 2.5 percentage points. Robustness checks were undertaken – I excluded people over the age of 75 from the sample, included a quadratic term for age in the regression, and tested age categories rather than age as a continuous variable (see Appendix B). Although the likelihood of having a claim appears to increase for those over the age of 75, the sample size is small, and these alternative models have little impact on results. The preferred specification is with the full sample and no quadratic term for age because injuries generally decrease with age (apart from some small increase at ages over 75).

The coefficients on household income, being employed, and working more than 60 hours per week are small and not statistically significantly different from zero. Conditional on having had an injury, these variables appear not to influence the decision to be treated and make a claim.

It might be expected that people who work in physical or dangerous occupations are more likely to have an ACC claim following injury because an injury would be more likely to impact on their ability to work (and therefore increase the disutility associated with living with an untreated injury). I find some support for this. Machinery workers and drivers (eight percentage points, significant at the 5% level) and market-oriented agriculture and fisheries workers (seven percentage points, significant at the 10% level) are more likely to make an ACC claim relative to managers.

Health characteristics are only added in the final specification because they are likely to be correlated with socio-economic characteristics; however, including them does not alter the results from the prior specifications. People who have been admitted to hospital in the last 12 months are seven percentage points more likely to have made a claim. Those who have a negative view of their health relative to others are six percentage points less likely to have made an ACC claim. Having a negative view of health may impact negatively on the perceived value of treatment.

Migrants may be thought to be less likely to make a claim because they may be less familiar with the ACC system; however, the coefficient on 'New Zealand born' is small and not statistically significantly different from zero. Although permanent migrants will be captured in the IDI through the immigration data, the longitudinal nature of the survey means that new migrants are largely excluded from the sample.

Deferring a visit to the doctor because of cost is associated with a three percentage points lower likelihood of making an ACC claim, although this is only significantly different from zero at the 10% level.

Restricting the sample to people who had a limiting injury at work, the sample size reduces to about 900 observations. In the final specification, the small sample size means none of the estimates are statistically significantly different to zero, but the size and direction of the coefficients are similar to the unrestricted sample. The results are not presented here.

6.6.2 Characteristics associated with having a limiting injury in the same year as having an accepted injury claim

Looking at the ACC claims data, some people said in SoFIE that they had not had a limiting injury in the last 12 months but according to the match to ACC data, they received loss of earnings compensation for more than a week away from work (see Table 6.5). This is surprising because I would expect paid work to be considered a usual activity.

One explanation might be that there is a lag between when the injury occurred and when the time off work was taken. For example, a person may be able to keep working initially after an accident but some months later may require time off work following surgery for the injury. If the interview was taken in between these two points in time it would explain the difference in the results. I do not have data on this, so I test whether loss of earnings compensation claims that occurred close to the interview date are less likely to be reported as limiting. I find that this is the case; if the accident is within a month of the interview date, people with loss of earnings claims are less likely to report that their injury was limiting, relative to people whose injury occurred more than a month before the interview date (see Table 6.6).

Table 6.7 compares the types of injuries incurred by those who had any type of ACC claim in the last 12 months by whether they report having had a limiting injury. Those who were more likely to report having had a limiting injury include those who had a claim for a fracture or dislocation (46.8%) or an amputation (45.2%).

Table 6.8 displays the results of a linear regression with a binary dependent variable indicating whether the person reported a limiting injury in the last 12 months. The sample is restricted to people who had an accepted ACC claim in the last 12 months. Injury type is the most important explanatory variable, along with indicators about the seriousness of the injury such as the size of the compensation payments and whether they involved entitlement payments. The coefficient on the variable ‘days since accident date’ is negative, consistent with the possibility of recall bias. Age, employment and living with a partner are all negatively associated with reporting an injury as limiting, possibly indicating that these variables are associated with an ability to continue doing usual activities despite time off work for injury.

6.7 Discussion

About a third of workers who report having an injury at work in the last 12 months that stops them doing their usual activities for more than a week do not appear to have received accident compensation for that injury. This is consistent with international estimates of the proportion of workers who do not make a workers' compensation claim for injury involving more than a week off work (Mustard et al., 2003; Safe Work Australia, 2011; Shannon & Lowe, 2002). It is surprising that the New Zealand estimate is not lower, because I expected that the claims process would be simpler in a universal claims environment where treatment providers submit the claims rather than the workers and the requirement for proof that an injury is work-related is alleviated.

One explanation may be that the sort of injuries that stop usual activity for more than a week are less incapacitating than injury that stops work for more than a week. This is supported by analysis of claims data. Two-thirds of those who made an ACC claim received cover for medical treatment only, which indicates that the injured person was not away from work for more than a week.[11] This would mean that responses to this type of survey question are not directly comparable to survey questions that ask about injury resulting in more than a week away from work. It seems likely that seriousness of the injury influences decisions on whether to seek treatment (Alamgir et al., 2006; Biddle & Roberts, 2003; Qin et al., 2014; Shannon & Lowe, 2002). SoFIE does not ask any questions about injury severity or treatment so I cannot assess whether those with a limiting injury who did not make a claim would have been entitled to ACC compensation. For example, the injury might not have been serious enough to require treatment in which case it would not be compensable.

[11] The employer covers the first week of absence and ACC pays entitlements for any subsequent time away from work.

The result is not specific to work. When considering all people who had an injury, whether at work or not, a similar proportion did not have a compensation claim (a third of injured people). This suggests that the causes of non-claiming go beyond work-specific factors. The decision on whether to obtain treatment for the injury is likely to be a significant factor in whether a claim is made.

One of the strongest findings in the regression analysis was that people of Chinese ethnicity who reported a limiting injury were about 29 percentage points less likely to have an ACC claim relative to those of European ethnicity. The literature indicates that Chinese people in New Zealand, may face language and cultural differences that act as barriers to accessing primary healthcare and accident compensation services, increasing the costs of effort involved in obtaining treatment and making a claim (DeSouza & Garrett, 2005; Sobrun-Maharaj et al., 2010). Chinese people in New Zealand, have better average self-reported health relative to New Zealand Europeans (Ministry of Health, 2012). This may also act as a barrier, as fewer people within the community will have had prior experience with treatment providers. Although this study is based on data from 2002-2009, indications are that people of Asian ethnicity continue to be under-represented among those that make ACC claims.[12]

Propensity to claim for a limiting injury also decreases with age, possibly reflecting attitudes and access to healthcare treatment. This result is consistent with the findings of (Alamgir et al., 2006) and (Krueger, 1990) who also found that younger workers were more likely to claim for work injuries. Younger workers may face lower costs of effort in obtaining treatment.

I find that people who had an injury which involved more than a week off work are less likely to report the injury as limiting if the injury occurred within a month of the

[12] Based on analysis of 2014 ACC work-related claims.

interview date. This implies there may be a gap between when an injury occurs, and time being taken off work.

This study was restricted to accepted claims because this was the only information available at the time; however, declined claims have since been added to the IDI. One possible area for future research is to look at whether some of those who had a limiting injury lodged a claim which was denied. A better understanding of declined claims would be required though, as it is possible these claims include some declined for administrative reasons (e.g., it is a claim for a firm that is in the AEP scheme, so it is declined by ACC and forwarded to the AEP provider).

6.8 Recommendations

Research that relies on claims data to assess changes in injury rates should be accompanied by a robustness check using injury types less affected by differential healthcare utilisation.

Research using more than a week off work injury claim should apply a lag to the data to improve stability of the data since there is often a lag between the date of the injury and the date in which time off work is taken.

Although the SoFIE survey data do not enable further analysis by injury type and severity, this research emphasises the important role of survey data within injury surveillance. This is an important source of information for countries that rely on workers' compensation data for monitoring of work-related injury trends, such as New Zealand and Canada.

6.9 Tables and Figures

Table 6.1: Cross-tabulation of the SoFIE sample by whether they had an accepted ACC claim for an injury that occurred in the last 12 months

	Number of observations (unweighted)	Population represented	No ACC claim	ACC claim		
				Entitlement claim		Medical fees only claim
				Loss of earnings	Home help only	
Full sample	51,147	8,517,800	72%	2%	1%	25%
Sample of workers	33,597	5,776,300	70%	2%	1%	26%
All people with a limiting injury	6,441	1,053,400	32%	12%	5%	50%
All people with a traffic limiting injury	225	38,500	26%	19%	4%	50%
Workers with a limiting injury	4,053	688,500	31%	17%	3%	49%
Workers with a limiting injury at work	1,113	184,300	30%	23%	2%	44%

Source: Statistics New Zealand IDI, confidentialised weighted pooled data, waves 3, 5 and 7. Excludes non-response.

Table 6.2: ACC claims in the last 12 months by funding account and injury setting

Sample	Location of limiting injury	Population with a claim in the last 12 months	At least one claim in the last 12 months was in the work account[1]
All respondents	Full weighted sample	2,409,800	20%
	Limiting injury	713,400	19%
	Limiting injury at work	146,000	70%
	Limiting injury at work on the road	2,500	40%
Workers	Full weighted sample of workers	1,715,200	26%
	Limiting injury	473,800	26%
	Limiting injury at work	128,600	72%
	Limiting injury at work on the road	2,200	suppressed

[1] A claim is allocated to the Work Account if the injury happened at work (excluding motor vehicle accidents on public roads) and the person is in paid employment and is 15 years of age or older. Unweighted counts of less than six have been suppressed for confidentiality.

Source: Statistics New Zealand IDI, confidentialised weighted pooled data, waves 3, 5 and 7.

Table 6.3: Descriptive characteristics

Variables	Number with limiting injury	% who had a claim
Full sample	1,053,400	68%
Ethnicity		
NZ European only	755,100	69%
Other European only	50,900	70%
Māori only	75,300	59%
Samoan only	17,600	68%
Chinese only	16,400	47%
NZ European & Māori	56,200	69%
Other ethnicity/ethnicities	81,800	63%
Gender		
Female	493,700	66%
Male	559,700	69%
Age		
15-24 years	230,200	75%
25-64 years	659,100	66%
65+	164,100	65%
Born in NZ		
No	183,400	64%
Yes	870,100	68%
Highest qualification		
None	230,200	64%
School	290,000	71%
Vocational	347,700	68%
Degree	165,600	66%
Other post school	19,600	74%
Missing	-	-
Occupation		
Managers	110,500	67%
Professionals	106,500	66%
Associate Professionals	72,500	64%
Clerical Services	88,900	72%
Community & Personal Serv.	133,600	69%
Agriculture & Fishing	56,800	73%
Craft & Trades Workers	66,600	69%
Machinery Operators	63,500	73%
Labourers & Related Work	59,500	67%
Not working	294,800	65%
Continuous variables (mean)		
Age	43.1	
Annual earnings	$23,153	
Annual earnings (excl. none)	$37,778	
Household earnings	$77,578	
Weekly hours	24.6	

Variables	Number with a limiting injury	% who had a claim
Partnered		
No	463,900	70%
Yes	589,100	66%
Employed		
No	364,900	66%
Yes	688,500	69%
Urban		
Main urban	752,500	68%
Secondary urban	68,600	64%
Minor urban	81,400	65%
Rural	150,900	67%
Firm size		
1-19 employees	52,700	68%
20-249 employees	92,200	73%
250+ employees	658,100	68%
Other	250,300	65%
Put off visiting a doctor in the last 12 months because of cost		
No	862,200	68%
Yes	188,800	66%
Missing	2400	88%
Would visit primary healthcare provider with new problem		
Definitely	719,400	69%
Probably	221,000	67%
Probably not	24,000	67%
Definitely not	6,800	59%
Missing	82,300	63%
As healthy as others		
Definitely true	366,400	70%
Mostly true	432,900	69%
Neither	118,100	63%
Mostly false	90,400	62%
Definitely false	41,000	61%
Missing	4,500	49%
More than one limiting injury in last 12 months		
No – only one.	704,500	66%
Yes	348,700	71%
Admitted to hospital in last 12 months		
No	856,100	67%
Yes	197,300	73%

Note: Weighted sample

Table 6.4: OLS predicting whether a person had an ACC claim in the last 12 months, given they had a limiting injury in the last 12 months

VARIABLES	(1)	(2)	(3)	(4)	(5)
Female	-0.0084	-0.0126	-0.00002	0.0017	0.0020
	(0.0124)	(0.0124)	(0.0134)	(0.0139)	(0.0139)
Age (10yrs)	-0.019***	-0.019***	-0.017***	-0.021***	-0.025***
	(0.00314)	(0.00343)	(0.00376)	(0.00396)	(0.00413)
Born in NZ		0.0145	0.0153	0.00348	0.00324
		(0.0221)	(0.0223)	(0.0226)	(0.0226)
NZ European (reference)					
Other European		0.0334	0.0390	0.0263	0.0305
		(0.0330)	(0.0332)	(0.0339)	(0.0339)
Māori		-0.118***	-0.118***	-0.115***	-0.119***
		(0.0271)	(0.0272)	(0.0282)	(0.0281)
Samoan		-0.0497	-0.0631	-0.0556	-0.0627
		(0.0534)	(0.0540)	(0.0565)	(0.0565)
Chinese		-0.249***	-0.245***	-0.291***	-0.289***
		(0.0669)	(0.0671)	(0.0694)	(0.0694)
European & Māori		-0.0570**	-0.0578**	-0.0410	-0.0421
		(0.0288)	(0.0287)	(0.0299)	(0.0297)
Other ethnicity/ies		-0.090***	-0.092***	-0.104***	-0.103***
		(0.0272)	(0.0275)	(0.0285)	(0.0284)
Lives with a partner		-0.0238*	-0.0329**	-0.0324**	-0.0263*
		(0.0131)	(0.0140)	(0.0144)	(0.0144)
No qualifications (reference)					
School qualifications		0.0454***	0.0479***	0.0476***	0.0468**
		(0.0174)	(0.0177)	(0.0182)	(0.0182)
Vocational		0.0311*	0.0354**	0.0376**	0.0370**
		(0.0167)	(0.0174)	(0.0178)	(0.0177)
Degree		0.00853	0.0233	0.0254	0.0248
		(0.0214)	(0.0239)	(0.0246)	(0.0246)
Other post-school		0.105**	0.104**	0.102**	0.0991**
		(0.0425)	(0.0427)	(0.0431)	(0.0426)
Main urban area (reference)					
Secondary urban area		-0.0309	-0.0363	-0.0420*	-0.0425*
		(0.0233)	(0.0235)	(0.0240)	(0.0239)
Minor urban area		-0.0198	-0.0216	-0.0260	-0.0256
		(0.0212)	(0.0214)	(0.0221)	(0.0221)
Rural area		-0.0136	-0.0287	-0.0426**	-0.0406*
		(0.0196)	(0.0206)	(0.0212)	(0.0212)
Log annual household income			0.00959	0.00724	0.00917
			(0.00694)	(0.00728)	(0.00728)
Employed at HED			-0.000576	-0.00160	-0.0153
			(0.0237)	(0.0244)	(0.0247)
Manager (reference)					
Professional			-0.0176	-0.0250	-0.0315
			(0.0290)	(0.0299)	(0.0298)
Associate Professional			-0.0222	-0.0134	-0.0201
			(0.0306)	(0.0316)	(0.0316)
Clerical Services			0.0376	0.0426	0.0338
			(0.0292)	(0.0301)	(0.0301)
Community & Personal Service			-0.00260	-0.00521	-0.0157

	(1)	(2)	(3)	(4)	(5)
			(0.0271)	(0.0280)	(0.0281)
Agricultural & Fisheries			0.0581	0.0579	0.0679*
			(0.0354)	(0.0366)	(0.0365)
Craft and Trades Workers			0.0416	0.0444	0.0422
			(0.0322)	(0.0334)	(0.0333)
Machine Operators & Drivers			0.0855***	0.0866***	0.0794**
			(0.0317)	(0.0325)	(0.0323)
Labourers			0.0134	0.00879	0.00284
			(0.0328)	(0.0340)	(0.0340)
No occupation (did not work)			0.00975	0.0123	0.00880
			(0.0323)	(0.0333)	(0.0332)
Works 60+ hours per week			0.0545	0.0374	0.0443
			(0.0385)	(0.0404)	(0.0399)
Put off visiting a doctor in last 12 months				-0.0248	-0.0302*
because of cost				(0.0170)	(0.0170)
Definitely as healthy as others (reference)					
Mostly as healthy as others				-0.00521	-0.00523
				(0.0141)	(0.0141)
Neither as healthy as others or not				-0.070***	-0.070***
				(0.0213)	(0.0212)
Mostly not as healthy as others				-0.0422*	-0.0448*
				(0.0236)	(0.0235)
Definitely not as healthy as others				-0.0589*	-0.0600*
				(0.0312)	(0.0310)
Would definitely visit primary healthcare provider with new problem (reference)					
Would probably visit				-0.0168	-0.0163
				(0.0151)	(0.0151)
Would probably not visit				0.0122	0.0133
				(0.0398)	(0.0399)
Would definitely not visit				-0.0513	-0.0502
				(0.0719)	(0.0713)
Admitted to hospital in last 12 months				0.0722***	0.0695***
				(0.0151)	(0.0151)
1-19 employees (reference)					
20-249 employees					-0.00113
					(0.0357)
250+ employees					0.00359
					(0.0307)
Other					-0.0626*
					(0.0329)
Constant	0.757***	0.760***	0.630***	0.703***	0.725***
	(0.0152)	(0.0307)	(0.0889)	(0.0948)	(0.0983)
Observations	6,438	6,432	6,381	5,943	5,943
R-squared	0.006	0.018	0.022	0.031	0.034

Note: Unweighted linear regression predicting whether a person had an ACC claim in the last 12 months, given they had a limiting injury in the last 12 months. Sample restricted to people who had a limiting injury in the last 12 months. Dependent variable equals one if they had an accepted claim with an accident in the 12 months before the SoFIE interview. Columns 1-5 are separate regressions, each column from left to right has further explanatory variables added as displayed.

*** p<0.01, ** p<0.05, * p<0.1

Table 6.5: Worker ACC claims in the last 12 months by whether the injury was limiting

	Number of observations	Limiting injury
Loss of earnings compensation claim	930	83%
Entitlement claim - no loss of earnings	606	59%
Medical fees only claim	12,873	25%

Source: Statistics New Zealand IDI, confidentialised weighted pooled data, waves 3, 5 and 7.

Table 6.6: Percent of weekly compensation claimants who stated that they did not have a limiting injury in the last 12 months by whether the claim accident date was within 30 days of the SoFIE interview

Claim injury was within 30 days of interview	Number with a claim in the last 12 months	Percent that did not report having had a limiting injury in last 12 months
Yes	14,400	25%
No	116,400	18%
Total	130,800	19%

Note: People who received injury compensation for more than a week off work were less likely to report having had a limiting injury if the injury occurred within 30 days before the interview.

Source: Statistics New Zealand IDI, confidentialised weighted pooled data, waves 3, 5 and 7.

Table 6.7: The likelihood of reporting a limiting injury in the last 12 months, having had an ACC claim in the last 12 months, by the type of injury claim.

VARIABLES	Number with a claim in last 12 months	Proportion with a limiting injury	Standard Error	95% Confidence Interval	
Laceration, puncture or sting	668,181	0.163	0.0005	0.162	0.163
Industries deafness	23,022	0.104	0.0020	0.102	0.106
Soft tissue injury	2,358,105	0.239	0.0003	0.238	0.239
Fracture or dislocation	243,720	0.468	0.0010	0.467	0.469
Foreign body in orifice or eye	108,702	0.081	0.0008	0.080	0.082
Burns	46,581	0.183	0.0018	0.181	0.185
Amputation	4,005	0.452	0.0079	0.444	0.460
Trauma induced hearing loss	4,971	0.016	0.0018	0.015	0.018
Hernia	7,221	0.253	0.0051	0.248	0.259
Dental injury	43,005	0.086	0.0014	0.085	0.088
Inhalation or ingestion (occupational)	4,104	0.088	0.0044	0.083	0.092
Occupational disease	3,696	0.149	0.0059	0.144	0.155
Concussion	25,152	0.300	0.0029	0.297	0.303
Gradual process – local inflammation	39,720	0.229	0.0021	0.226	0.231
Gradual process – compression syndromes	2,949	0.224	0.0077	0.216	0.231
Pain syndromes	60,738	0.214	0.0017	0.213	0.216
Other/none	82,074	0.196	0.0014	0.194	0.197
Total	3,725,940	0.231	0.0002	0.231	0.231

Note: Data have been weighted using longitudinal survey weights.

Table 6.8: Linear regression predicting whether a person who had a claim in the last 12 months also has a limiting injury

VARIABLES	(1)	(2)	(3)	(4)	(5)
Female	0.0156*	0.00665	0.00182	0.00691	-0.00650
	(0.00799)	(0.00806)	(0.00885)	(0.00858)	(0.00853)
Age (10 years)	-0.0144***	-0.00993***	-0.0168***	-0.0242***	-0.0204***
	(0.00213)	(0.00229)	(0.00253)	(0.00248)	(0.00247)
Born in New Zealand		0.0114	0.0145	0.00918	0.0108
		(0.0145)	(0.0145)	(0.0140)	(0.0138)
NZ European (reference)					
Other European		0.0484**	0.0467**	0.0377*	0.0369*
		(0.0223)	(0.0222)	(0.0214)	(0.0210)
Māori		-0.00414	-0.00993	-0.00417	-0.00805
		(0.0180)	(0.0180)	(0.0173)	(0.0171)
Samoan		-0.0150	-0.0285	-0.0322	-0.0297
		(0.0356)	(0.0360)	(0.0330)	(0.0324)
Chinese		-0.0738**	-0.0732*	-0.0618	-0.0620
		(0.0376)	(0.0387)	(0.0403)	(0.0393)
European & Māori		0.0450**	0.0407*	0.0309	0.0300
		(0.0217)	(0.0219)	(0.0208)	(0.0205)
Other ethnicity/ies		-0.0304*	-0.0377**	-0.0282	-0.0282*
		(0.0177)	(0.0178)	(0.0172)	(0.0170)
Lives with a partner		-0.0622***	-0.0416***	-0.0333***	-0.0344***
		(0.00855)	(0.00919)	(0.00882)	(0.00874)
No qualifications (reference)					
School qualifications		0.000801	0.0105	0.0133	0.0126
		(0.0115)	(0.0116)	(0.0113)	(0.0111)
Vocational		-0.0178*	0.000753	-0.000153	0.000907
		(0.0107)	(0.0111)	(0.0108)	(0.0107)
Degree		0.00412	0.0360**	0.0390***	0.0350**
		(0.0141)	(0.0155)	(0.0150)	(0.0148)
Other post-school		0.0245	0.0400	0.0404	0.0475
		(0.0305)	(0.0308)	(0.0298)	(0.0296)
Main urban area (reference)					
Secondary urban area		-0.0130	-0.0135	0.00286	0.00203
		(0.0150)	(0.0150)	(0.0148)	(0.0147)
Minor urban area		-0.00322	-0.00783	-0.00538	-0.00166
		(0.0134)	(0.0135)	(0.0131)	(0.0130)
Rural area		-0.0151	-0.0175	-0.0125	-0.0111
		(0.0126)	(0.0134)	(0.0128)	(0.0127)
Log annual household income			-0.00299	-0.00291	-0.00371
			(0.00488)	(0.00472)	(0.00469)
Employed at HED			-0.0770***	-0.0464***	-0.0494***
			(0.0175)	(0.0166)	(0.0163)
Manager (reference)					
Professional			0.00493	0.0230	0.0257
			(0.0172)	(0.0167)	(0.0165)
Associate Professional			0.0257	0.0262	0.0269
			(0.0186)	(0.0177)	(0.0175)
Clerical Services			0.0207	0.0243	0.0270
			(0.0179)	(0.0170)	(0.0169)
Community & Personal Service			0.0147	0.0116	0.0164
			(0.0165)	(0.0157)	(0.0156)
Agricultural & Fisheries			0.0401*	0.0221	0.0308
			(0.0224)	(0.0211)	(0.0208)
Craft and Trades Workers			0.0108	-0.0235	-0.0156
			(0.0194)	(0.0179)	(0.0177)
Machine Operators & Drivers			0.0478**	0.0137	0.0246
			(0.0197)	(0.0184)	(0.0182)
Labourers			0.0182	0.0114	0.0147
			(0.0206)	(0.0192)	(0.0191)

No occupation (did not work)			0.0194	0.0647***	0.0616***
			(0.0222)	(0.0212)	(0.0209)
Works 60+ hours per week			-0.000481	-0.00573	-0.00566
			(0.0234)	(0.0217)	(0.0218)
Log(ACC compensation paid)				0.0559***	0.0532***
				(0.00315)	(0.00320)
Days between injury and interview (10)				-0.00335***	-0.00327***
				(0.000347)	(0.000342)
Entitlement claim (serious injury)				0.332***	0.325***
				(0.0160)	(0.0161)
Laceration, puncture or sting (reference)					
Industrial deafness					-0.389***
					(0.0515)
Soft tissue injury					0.0637***
					(0.00931)
Fracture or dislocation					0.209***
					(0.0184)
Foreign body in orifice or eye					-0.0540***
					(0.0184)
Burns					0.0289
					(0.0319)
Amputation					0.315***
					(0.0949)
Trauma induced hearing loss					-0.240***
					(0.0527)
Hernia					-0.264***
					(0.0956)
Dental injury					-0.140***
					(0.0293)
Inhalation or ingestion (specific occupations)					-0.0619
					(0.0812)
Occupational disease					-0.132
					(0.0956)
Concussion					0.113**
					(0.0498)
Gradual process – local inflammation					-0.00159
					(0.0370)
Gradual process – compress syndrome					-0.289**
					(0.124)
Pain syndromes					0.0565*
					(0.0294)
Other/none					0.00899
					(0.0280)
Constant	0.357***	0.376***	0.451***	0.189***	0.150**
	(0.0111)	(0.0213)	(0.0614)	(0.0614)	(0.0615)
Observations	14,409	14,394	14,259	13,422	13,422
R-squared	0.004	0.010	0.016	0.156	0.178

Note: This is an unweighted linear probability regression. The sample is restricted to people who had an accepted ACC claim with an accident date in the 12 months before the SoFIE interview. The dependent variable is one if the person reported having experienced a limiting injury in the last 12 months in SoFIE, zero otherwise.

*** p<0.01, ** p<0.05, * p<0.1

Chapter 7

Experience rating: Injury prevention or claims shifting?

7.1 Introduction

The previous chapter finds that a substantial proportion of injured people do not receive accident compensation. Despite this, if underreporting is consistent over time then claims data can be reliably used to assess the impact of injury prevention interventions; however, if an intervention inadvertently increases underreporting of injury then it cannot be concluded that a reduction in claims corresponds to a reduction in injury.

This chapter investigates one such policy intervention - experience rating. I use a continuous treatment variable – the degree to which a firm's claims history affects its insurance levy under experience rating – and interact it with the period following the introduction of experience rating to test whether firms that received stronger treatment had larger decreases in work claims following the policy's introduction. I then look for evidence of claims shifting behaviour by testing whether any decrease in work claims is associated with a corresponding increase in earner account claims, controlling for firm characteristics.

7.2 Economic Theory

As described in chapter 4, firms maximise profits by choosing a level of safety effort, s, and claims management activity t, with associated costs of effort $Z(s,t)$. The degree of experience rating varies by α, with incentives to increase both safety effort and claims management increasing with α.

$$Profits(s,t) = z\Big(\big(1 - P(s)\big)\mathrm{N}\Big) - W\big(1 - P(s)\big) - \alpha P(s)N[\Pi(t)B] - (1 - \alpha)FN - Z(s,t) \tag{7.1}$$

where $z(.)$ is a concave production function and firm's product price has been normalised to 1.

I hypothesise that firms will respond to the introduction of experience rating with both a safety response and a claims management response, resulting in a decline in work claims and a small increase in off-the-job claims (hypothesis 5 in chapter 4).

7.3 Literature

Experience rating has been found to be effective at reducing workers' compensation claims in other jurisdictions (De Groot & Koning, 2016; Lengagne, 2016; Tompa, Cullen, et al., 2012). Tompa, Cullen, et al. (2012) undertake a systematic literature review on the effectiveness of experience rating, updating an earlier article on this topic. The quality of studies is assessed and those of low quality are excluded from the review. An algorithm is used to determine the strength of evidence found. The authors conclude that there is moderate evidence that the introduction of experience rating is associated with a decrease in the frequency of reported injuries (based on six studies) and moderate evidence that the degree of experience rating is associated with a decrease in the frequency and severity of reported injuries (based on seven studies). The authors comment that most of the studies are based on claims data and none of them directly address the fact that claims may under-represent injuries. They reflect that several of the studies looked at different injury types which may indirectly provide information about claims shifting from lost-time claims to medical treatment only claims but none of the studies found any evidence in support of this.

(De Groot & Koning, 2016) take a difference-in-difference approach using linked employer-employee administrative data to look at the impact of experience rating on disability insurance in the Netherlands. Experience rating was removed for small firms and the authors look at the impact on benefit inflows and outflows relative to large firms, which remained experience rated. They found that the removal of experience rating increased the disability inflow by seven percentage points and decreased outflow by 12 percentage points. However, the authors do not investigate whether this is a result of fewer injuries or fewer claims.

Lengagne (2016) uses survey data on working conditions as reported by workers to look at whether experience rating is associated with firm safety behaviour and self-reported injury in France. Firms with 10 or fewer workers are not subjected to experience rating, firms with 200 or more workers are fully experience rated, and firms with 11-199 workers have a degree of experience rating that increases with firm size. The authors assume that if an industry’s insurance premium rate increases, it reflects an industry-wide shock. They also assume that industries with a higher proportion of firms that are experience rated will react more strongly to an increase in insurance premiums than industries with fewer experience rated firms. The paper aggregates the working conditions survey results to the industry level and combines it with industry levy rate information to look at variation in safety behaviour relative to industry levy increases. They find that industries with more experience rated firms respond to an increase in industry levies by reducing tiring postures and movements, reducing dust and smoke exposure and reducing injuries. The author suggests that more research should be done to look at other possible employer responses such as claims management.

Some work has been done to look at claims management based on the type of injury or the type of benefit. Tompa, Hogg-Johnson, et al. (2012) look at claim types thought to be associated with claims management: no-lost-time permanent impairment claims, disputed/denied claims, claim types excluded from experience rating, and claims that reopen after the experience-rating window (when the costs no longer impact directly on the employers' levy). They find that a higher degree of experience rating is positively related to these types of claims.

Fortin and Lanoie (1992) look at whether the duration of injuries vary based on the size of benefits from workers' compensation relative to unemployment insurance. They find evidence of a substitution effect between the two systems. The average duration of injuries increases with an increase in workers' compensation benefits and decreases when unemployment benefits increase.

7.4 Background

The New Zealand ACC experience rating scheme was introduced in July 2011. It has two components: a no claims discount for small levy payers, low-risk levy payers[13] and self-employed levy payers; and an experience rating loading or discount for large and high-risk employers.[14] I focus here on the experience rating part of the scheme, although I briefly describe the no claims discount scheme below. The scheme is compulsory for all eligible firms. To be eligible for experience rating a firm must meet the minimum threshold for levy payments, have three years of claims history and must not be a member of the Accredited Employer Programme.

Under the no claims discount scheme levy payers receive a 10 percent discount (decrease) if they had no weekly compensation claims and no fatality claims in the last three years. The levy payer receives a 10 percent loading (increase) on their levy if they paid out more than 71 days of weekly compensation to their employees over the last three years or had one or more fatality claims. If neither of these applies, then no adjustment is made to the levy.

[13] Levies less than $10,000 in at least one of the last three years.
[14] Levies of $10,000 or more in each of the last three years.

Under the experience rating programme, levy adjustments are based on the firm's claims history for the last three years relative to that of similar sized firms in the same industry. Firms with a better relative claims history receive a levy discount and those with a relatively worse claims history receive a levy loading. The adjustment is primarily based on the number of weekly compensation days paid (days off work), but also incorporates the number of claims with over $500 paid out for costs of treatment and the number of fatal claims.[15] There is a maximum adjustment that is used for the experience rating modification. When experience rating was first introduced the maximum experience rating loading (increase) was 35% and the maximum discount (decrease) was also 35%. From 1 April 2014 the maximum loading was increased to 60%.

In the year ending March 2012, the highest levy rate was $9.01 per $100 of liable earnings, the lowest was $0.04 per $100 of liable earnings, and the mean was $1.41 per $100 of liable earnings. For a company employing one hundred people with an average wage of $40,000 at the average levy rate, this would equate to annual levies of $56,400 and a 35% loading would equate to almost $20,000; however, a company of this size would receive a small rating factor (weighting) of around 9%. This would reduce the loading to about $5,000.

It is not clear whether the experience rating incentives in New Zealand are strong enough to influence behaviour change. Feedback from employers suggests that the size of the discounts and loadings may not be large enough to achieve this in New Zealand (Ministry of Business, Innovation & Employment & Accident Compensation Corporation, 2015).

[15] An 'off-balance adjustment' is also applied to the experience rating modification to ensure that the aggregate value of discounts equals the aggregate value of loadings. The scheme also has an industry size modification. If large firms have lower history in terms of weekly compensation days relative to medium-size firms in the same industry, then they receive a levy discount (and vice versa).

The extent to which experience rating is applied varies by firm size. Firm size is measured using liable earnings. The claims history of larger firms is weighted more heavily when making levy adjustments compared to smaller firms because larger firms' claims history is subject to less random variation. The weighting formula is designed to minimise discontinuities, thereby preventing the use of discontinuity analysis to estimate the effect of the scheme; however, if experience rating is successful, I would expect that firms with a higher weighting would have a stronger response to experience rating incentives than firms with a lower weighting. I use this feature to evaluate the impact of the introduction of experience rating on injury claims.

The New Zealand experience rating programme has previously been evaluated by MBIE and ACC (Ministry of Business, Innovation & Employment & Accident Compensation Corporation, 2015). They review the claim rate trend lines for 1,800 businesses and find a lot of variation at the individual level. They also look in depth into 200 businesses. They find that those with particularly high or low claim rates saw a decline post-2011; those with high liable earnings had a step change decline post-2011; and those operating in high-risk industries also saw a decline in claim rates. They also look at firms with high discounts (low injury rates relative to their peers') or loadings (high injury rates relative to their peers') but are unable to distinguish between the impact of experience rating and mean reversion. Overall, they conclude that the financial incentives are not strong enough to create wide-spread behaviour change and that strengthening the incentives would not help because of the strong random component that sits behind claim rates.

This work differs from the MBIE evaluation in two main ways. Firstly, I use differences in the weighting of experience rating to better identify the impact on work claims. Second, I look at the impact on earner account claims to better investigate claims shifting. Like the previous chapter, this research uses data from the IDI (see chapter 5 for a general description). Experience rating programme data are not included in the IDI, so I have derived some of the relevant variables for firms. This section describes these variables.

7.4.1 Estimating 'liable earnings'

ACC uses liable earnings to calculate the levies that firms are charged (insurance premiums). I calculate liable earnings using the Employer Monthly Schedule (EMS) data. The EMS includes monthly information on wages and salaries and a variable called 'earnings not liable for ACC levies'. Earnings that are not liable for ACC levies include an individual earnings cap and some types of earnings such as redundancy payments. I estimate liable earnings for enterprises by subtracting 'earnings not liable for ACC levies' from gross earnings and aggregating the information to the year ending March.

7.4.2 Estimating ACC levies

Enterprises are excluded from experience rating if their levies are less than $10,000 in any of the three years used to estimate their claims history. The levy rate is the insurance premium that ACC charges per $100 of liable earnings. The levy rate is based on the levy risk group of the firm ('classification unit'), which is industry-based. ACC provided me with levy rate information by levy year (year ending March) and classification unit along with a mapping table for assigning classification units to ANZSIC06 industries (these are available on request). I use these data to estimate the firm's levy by multiplying the levy rate by the firm's liable earnings at the geographic unit for the firm (based on the permanent business number (PBN)). These are then summed to the enterprise level. I believe that this provides a good estimate of firms' levies since most of the data are the same as that used by ACC to calculate levies. In some circumstances the levy risk group used by ACC will differ to the one I have obtained by mapping it to the detailed ANZSIC06 industry. I expect the differences will be small and unbiased because I think most levy risk groups match well to industry and where it does not it will contain both over- and under-estimates. Enterprises with levies of less than $10,000 in any of the three years used to estimate their claims history are excluded from the analysis.

7.4.3 The Accredited Employer Programme

Firms in the Accredited Employer Programme (AEP) are not included in experience rating. There is no indicator in the data for whether a firm is in the AEP, but there is an indicator for whether a claim is an AEP claim. Some firms have a mixture of AEP and ACC claims. There are few possible reasons for this. The nature of the scheme means that some firms no longer in the AEP scheme still have AEP claims because they are still responsible for ongoing payments for historical claims. There are also some firms in the AEP who have non-AEP claims (e.g., if the cost of the claim rises above an agreed amount the claim may revert to an ACC claim).

Although most firm-year observations have no AEP claims (97%), those that have at least one AEP claim vary in the percent of claims that are AEP. Figure 7.1 displays the distribution for observations with at least one AEP claim. Most have either a low proportion of AEP claims (for 25% of observations, AEP claims make up 10% or fewer of their claims) or a high proportion of AEP claims (for 36% of observations, AEP claims make up 90% or more of their claims).

To manage this, I apply a rule that if more than 80% of an enterprise's claims in a given year are marked as AEP claims, the enterprise is excluded from the experience rating analysis. The results are not sensitive to how an AEP firm is defined. The robustness checks in Appendix D indicate that the results are robust to increasing the cut-off to 95% AEP claims and reducing the cut-off to 5% AEP claims.

7.4.4 Experience-rated firms

To restrict my sample to firms eligible for experience rating I exclude enterprises where more than 80% of their claims are AEP claims, enterprises with estimated levies of less than or equal to $10,000 in any of the three years in the experience period and any firms present in the data for fewer than three years in a row. Nine percent of enterprise-year observations remain after these exclusions are implemented.

7.4.5 The unit of analysis

ACC group together commonly owned businesses so that experience rating is based on common control of the workplace (Accident Compensation Corporation, 2011). Each levy payer in the grouping will receive the same discount or loading based on the group's performance. Therefore, I estimate firm variables such as the rating factor at the enterprise level. Since inclusion in experience rating is based on enterprise information I exclude PBNs that change enterprise partway through the year.[16]

The experience rating modification is based on comparison of a firms' performance relative to its industry peer group.[17] It seems likely that an enterprise might respond to experience rating by making industry-specific safety improvements rather than enterprise-wide changes. Although some health and safety improvements may be implemented at the enterprise level (e.g., health and safety audits) most interventions would probably be industry-specific (e.g., improved machine guarding for the manufacturing companies). To allow for this, the unit of the firms used here is a grouping

[16] 31% of PBN-year observations changed enterprise during the year. Fabling (2011) states that some changes in the link between PBN and enterprise number may be a result of changes to the legal entity rather than changes to the firm. For example, if a sole proprietor becomes an incorporated entity the enterprise number may change. I do not think this would have a large impact here because most experience rated firms are large and therefore less likely to change entity in this way; however, future work could use the method proposed by Fabling (2011) to repair "broken" links, which could potentially increase the number of PBNs included in this study.

[17] The industry peer group is defined in the Experience Rating Regulations 2016, s9. The definition is based on industry and firm size.

of PBNs that belong to the same enterprise and operate within the same industry classification unit. The final study population consists of an average of 5,972 firms per year, with ten years of data from 2006 to 2015.

7.4.6 The Rating Factor

The Rating Factor (RF) is calculated using the formula stated in the experience rating regulations (see Appendix D). A Rating Factor of one implies that the firm is fully experience rated, whereby a low RF (e.g., 0.1) implies that the firms claims history only has a small impact on levy adjustments. The Rating Factor is derived from liable earnings, meaning that it is strongly correlated with the number of employees in the firm (correlation coefficient of 0.72). The Rating Factor used in the regressions has been standardised with a mean of zero and a standard deviation of one.

7.4.7 Other variables

Outcome variable

The outcome variable is claims with treatment costs greater than $500 as this is one of the variables used directly in the experience rating calculations. I also look at treatment-only claims, total claims, weekly compensation claims (lost-time injury) and the average number of compensated days per weekly compensation claim.

March years

I include year fixed effects. The ACC levy year runs from 1 April to 31 March, so I use years ending March. Experience rating was introduced in April 2011- the start of the year ending March 2012.

Number of employees

Modelling the relationship between the number of employees and the number of claims for the firm presents a challenge. It seems likely that there are economies of scale in injury prevention. Large firms are found to have lower injury rates than small firms for fatalities (Fabiano, Currò, & Pastorino, 2004; Mendeloff, Nelson, Ko, & Haviland, 2006), major injury (Kines & Mikkelsen, 2003; Nichols, Dennis, & Guy, 1995), and lost-time injury (McVittie, Banikin, & Brocklebank, 1997). To address this, I control for the number of employees in the firm and its quadratic. Economies of scale may take place at either the firm level or the enterprise level. To address this, I include a categorical variable for the number of employees at the enterprise level interacted with a dummy variable for whether the firm is part of larger enterprise.

I also estimate a version with the rate of claims per 1,000 employees as the dependent variable and control for just the number of employees on the right hand side (excluding the quadratic).

Monthly earnings categories

Information on the occupation mix of the firms is not available so I use monthly earnings as a proxy. The variable used captures the percent of employees whose monthly earnings are within five categories: [$0, $1,000]; ($1,000, $2,000]; ($2,000, $5,000]; ($5,000, $10,000]; and over $10,000. Earnings are in 2015 dollars, adjusted using the consumer price index.

Employee turnover

Employee turnover is the average monthly number of employees who leave the firm divided by the total number of employees.

Multi-site firm

This is a dummy variable that equals one if the firm consists of more than one PBN.

Enterprise age

This variable is intended to capture firm maturity. Data are only available from the year ending March 2000 onwards, so it measures the number of years the enterprise has been in existence since the year 2000. There are four categories: 5 years or less; (5 years, 10 years]; (10 years, 15 years]; and over 15 years

Firm Industry

Firm industry is measured at the two-digit level using the Australia and New Zealand Standard Industry Classification 2006 (ANSIC06).

Demographic characteristics

I include a variable for the percent of employees that are male. This variable is likely to also capture some of the occupation mix information as many high-risk occupations, such as tree harvesting and construction, are male-dominated. I also include variables for the proportion of young workers aged 25 years or under and older workers aged over 60 years. Younger workers have been found to have higher injury rates, while older workers tend to experience more serious injuries following an accident (Salminen, 2004).

7.5 Empirical Strategy

7.5.1 Identification Strategy

Experience rating is compulsory for all firms that meet the eligibility requirements. Firms that do not meet the eligibility requirements - firms in the Accredited Employers Programme and new firms with less than three years of claims history - are not considered similar enough to provide a good control group. The reason is that firms choose whether to participate in the Accredited Employer Programme, which raises the issue of self-selection bias, while new firms are likely to differ in many unobservable ways from established firms (e.g., financing, management practices, staff tenure, growth rates). Mean reversion in injury rates mean that low injury firms are not able to be used as a control group. Low risk industries are not a suitable control group either because they have different trends in injury patterns to high risk industries. I choose not to compare firms in the experience rating programme with those in the no claims discount programme because it is not clear *a priori* what the incentive effects are at the boundary between the two programmes.

Instead I regard RF as a treatment intensity variable as it represents the degree to which a firm's claims history impacts on its future levies. This is similar to the approach used by (Tompa et al., 2013). I fix RF at the average value for the firm prior to the introduction of experience rating (2006-2010) so that treatment intensity is not affected if the firm adjusts liable earnings in response to experience rating. I exclude the year before the introduction (2011) from the fixed RF value to avoid any anticipation effects. Firms not present in any year in the period 2006-2010 are excluded from the analysis.

I look at whether treatment intensity is associated with a change in claims following the introduction of experience rating compared to the period before its introduction. I do this separately for work claims and off-the-job claims to look for any evidence of claims shifting.

The linear version of this model is shown in equation 7.1. Y is the number of claims, RF is the treatment intensity variable, $\mathrm{POST2011}$ is a dummy variable that equals one for the years after the introduction of experience rating, α_t represents year fixed effects and X is a matrix of firm characteristics (including the number of employees and its quadratic).

$$Y_{it} = \alpha + \gamma RF_{it} * POST2011 + \delta RF_{it} + \alpha_t + \beta X_{it} + \varepsilon_{it} \tag{7.1}$$

The main variable of interest is the interaction between RF and post_2011. If the introduction of experience rating incentivised firms to reduce claims, then the coefficient on this variable will be negative and statistically significant.

This approach relies on the assumption that trends in claims by RF are parallel prior to the introduction of experience rating. To check this assumption, I restrict the data to the period prior to the introduction of experience rating and apply two tests. Firstly, I replace the interaction variable with a time trend interacted with the RF. If the parallel trends assumption holds, I expect the coefficient to be not statistically significantly different from zero. Second, I run a placebo test in which I replace the post-2011 variable with that of a different year. Once again, this coefficient should not be statistically significantly different from zero if the parallel trends assumption holds. Rather than picking just one year, I run the placebo test for three years – post-2007, post-2008 and post-2009 to check that I have not picked an unusual year. I do not include the year before the introduction of experience rating as a placebo because it may be confounded by anticipation effects. I run these tests for both the number of claims and the rate of claims per 1,000 employees.

7.5.2 Modelling injuries

Count models are generally preferred to linear and log-linear models for modelling injury data because injuries have a lower bound of zero (OLS may predict negative values) and many firms have no injuries, which can make the use of a log-linear model problematic. Experience rated firms are generally large and therefore are more likely to have injury claims relative to all firms; however, despite this nine percent of firm-year observations have no work claims and five percent have no earner claims associated with their workers. A much higher proportion of firm-year observations have no claims with medical costs of over $500 (52 percent for work claims and 31 percent for earner claims).

An alternative option is the Poisson model, which assumes that the mean is equal to the variance. Like other studies of firm injuries (Ruser, 1993; Tompa et al., 2013), I reject this assumption, observing over-dispersion in the data, which is likely to arise because most firms have either no claims or only a few. The Poisson quasi-maximum likelihood model and the negative binomial model both handle count data and zero inflation well;

however, they do not necessarily converge, particularly with a large number of firm fixed effects.

Unlike log transformations, the inverse hyperbolic sine transformation can be applied to values of zero (MacKinnon & Magee, 1990; Pence, 2006).

It can also be applied to negative values and has the feature of pulling extreme values toward the other transformed observations (Burbidge, Magee, & Robb, 1988).

Applying the inverse hyperbolic sine transformation to the dependent variable yields:

$$\tilde{Y} = \operatorname{arcsinh}(Y) = \ln\left(Y + \sqrt{Y^2 + 1}\right) \tag{7.2}$$

To recover Y from the left-hand side the inverse of the inverse hyperbolic sine is applied to both sides:

$$Y_{it} = \sinh\left(\hat{\alpha} + \hat{\beta} X_{it} + \varepsilon_{it}\right) \tag{7.3}$$

Bellemare and Wichman (2018) shows that the elasticity is:

$$\xi_{YX} = \hat{\beta} \cosh(\operatorname{arcsinh}(Y)) \,.\frac{X}{Y} = \hat{\beta} X.\frac{\sqrt{Y^2+1}}{Y} \tag{7.4}$$

For large values of Y, $\xi_{yx} \approx \hat{\beta} X$, because $\lim_{Y \to \infty} \frac{\sqrt{Y^2+1}}{Y} = 1$ (Bellemare & Wichman, 2018). Except for very small values of y, the inverse hyperbolic sine can be interpreted in the same way as a standard logarithmic dependent variable (Woolley, 2011) .

I use the inverse hyperbolic sine transformation for the main results. A robustness check indicates that the results are not sensitive to the choice of model (see section 7.6.4 for more details).

7.6 Results

7.6.1 Descriptive statistics

Table 7.1 displays the descriptive statistics for all years pooled together and broken down by the period before and after experience rating. The average number of work claims per firm is 9.14 (95% CI [9.00, 9.28]), while the average number of work claims with treatment costs greater than \$500 is 1.20 (95% CI [1.18, 1.22]). The average number of compensated days per weekly compensation work claim per firm is 91.6 days (95% CI [89.2, 94.1]). The number of earners' claims per firm tends to be higher, with an average of 22.83 total claims (95% CI [22.40, 23.26]) and an average of 3.63 claims with treatment costs greater than \$500 (95% CI [3.56, 3.70]). The average number of days off work per weekly compensation earners' claim is also slightly lower than that for work claims (74.3, 95% CI [72.6, 75.9]).

The average rating factor is 0.11 and a quarter of the firms are part of a larger enterprise. The employee turnover rate is 0.13. Average monthly earnings are \$3,650. On average, enterprises have been in existence for 10.8 years since 2000.

Next, I group firms into RF quartiles for descriptive purposes. Figure 7.2 displays the average number of work claims per firm by RF quartile. Firms with a higher RF have higher average numbers of work claims. From 2006 to 2009, the number of claims with treatment costs over \$500 was increasing across all RF groups. Numbers then decreased until 2011 when they levelled out. Although the patterns are similar across the groups, the rate of growth and decline appear larger for the higher RF groups than the lower RF groups.

Figure 7.3 displays the average rate per 1,000 employees of work claims with treatment costs of more than \$500 by RF quartile. Firms in the two lower RF quartiles have higher injury rates than those in the higher quartiles. Injury rates follow a similar pattern to the number of injuries although the pattern is less consistent across RF groups.

Figure 7.4 displays the average number of earners' claims per firm by RF quartile. Earners' claims follow a similar pattern to work claims, with an increasing number of claims up until 2009 and then a decline, with higher RF groups having larger rates of growth and decline than the lower RF groups.

Figure 7.5 displays the average rate per 1,000 employees of earners' claims with treatment costs of more than $500 by RF quartile. There is little difference in injury rates by RF quartile. This implies that employees who work for firms that have a higher intensity of experience rating have similar rates of off-the-job injuries as employees who work for firms that have a lower intensity of experience rating.

7.6.2 Parallel Trends

The approach used here relies on the assumption that trends in claim rates by RF are parallel prior to the introduction of experience rating. To test for parallel trends, I restrict the data to the pre-treatment period and include a time trend variable interacted with RF. If trends are parallel prior to the introduction of experience rating the coefficient will be zero. Table 7.2 displays the results using the inverse hyperbolic sine transformation. Columns 1 and 2 contain the results for work claims while columns 3 and 4 contain the results for earners' claims. The results are presented both with and without firm fixed effects. The top panel dependent variable is the number of claims with treatment costs greater than $500, while the bottom panel dependent variable is the rate of claims with treatment costs greater than $500 per 1,000 employees.

The coefficient on the time trend variable interacted with RF without firm fixed effects is 0.00463 (statistically significant) for the number of work claims and 0.00751 (statistically significant) for earners' claims. Adding firm fixed effects reduces the size of the coefficients, and the work claims coefficient is no longer statistically significant. This provides some support for the parallel trends assumption.

For the rate of claims per 1,000 employees, the coefficient on the interaction term is small and not statistically different from zero for work claims or earners' claims, and with and without firm fixed effects.

As described in section 7.5.2, I run a placebo test for three years in which experience rating was not introduced: 2007, 2008 and 2009. Table 7.3 displays the results. In most cases, the coefficients on the interaction between the time trend and RF appear to be decreasing over time, with the post-2007 coefficient being the highest and the post-2009 coefficient being the lowest. The pattern of the coefficients suggests that injuries and injury rates may have been decreasing more quickly among firms with higher RF prior to the introduction of experience rating. This implies that an assumption of parallel growth trends rather than parallel trends is more appropriate for these data.

Overall, the time trend test suggests that the parallel assumption holds when the work claims are used as the dependent variable but does not hold when earners' claims are used as the dependent variable. The placebo test indicates that there may have been some divergence in claims prior to the introduction of experience rating. I proceed with the analysis using a parallel growth trends assumption but acknowledge that the evidence for causation is weak and so the results should be interpreted with caution. Further comment is provided in the discussion (section 7.7).

7.6.3 Regression results

Injury claims with more than $500 of treatment costs

Table 7.4 displays the results of the inverse hyperbolic sine regression predicting the number of injury claims with treatment costs over $500. Columns 1-4 display the results for work claims while columns 5-8 display the results for earners' claims. The first columns (columns 1 and 5) control for the interaction term (RF*post2011), the rating factor (RF), the number of employees and its quadratic, and year fixed effects. Columns 2 and 6 add in firm characteristics. Columns 3 and 7 add in firm fixed effects (with industry excluded). Columns 4 and 8 add in a variable that is the interaction between the time trend and RF.

I focus here on the estimated coefficient for the interaction term of interest (RF*post2011) because I am interested in the relative impact of the introduction of experience rating, holding all else constant. The marginal effect for the interaction term is constant across the distribution of other covariates.

The coefficients on RF*post2011 are mostly negative and statistically significant. Computing the elasticities at the mean using formula 7.3, the results in column 2 indicate that a one standard deviation increase in the rating factor (0.09) in the period following the introduction of experience rating, holding all other variables at their mean value, is associated with a decrease in work claims of 2.4 percent. Adding firm fixed effects and the interaction between RF and the time trend (column 4) decreases the elasticity at the mean from 2.3 percent to 2.0 percent and it is no longer statistically significantly different from zero.

The coefficients on the variable RF*post2011 for the earners' claims regressions are all negative and the final specification (includes firm fixed effects and the time trend interacted with RF) is statistically significant. A one standard deviation increase in the rating factor is associated with a 3.3 percent decrease in earners' claims relative to the period before the introduction of experience rating (column 8), holding all other variables, including RF, at their mean value. This implies that any decrease in work claims is not a result of claims shifting (misreporting that work injuries occurred off-the-job) and that the response to experience rating may have had some spillover effects for off-the-job injury.[18]

Alternative claim types

I next look at whether the results are specific to claims with high treatment costs by running the same inverse hyperbolic sine model but using different types of claims as the dependent variable. I look at treatment-only claims (those not involving days off work or other entitlements), all claims, weekly compensation claims (more than a week off work) and the average number of compensated days off work per claim. Table 7.5 displays the results. The top panel displays the specification with the full set of controls including firm fixed effects and the time trend interacted with RF. The bottom panel displays the results excluding firm fixed effects.

The coefficients are all negative in the work claims specification without firm fixed effects; however once firm fixed effects are added the coefficients on RF*post2011 become small, positive and not statistically significantly different from zero. The same is true for the earners claims, apart from the average number of days off work which is positive and statistically different from zero at the 5% level both with and without firm fixed effects. It is possible that a focus on return-to-work for work injuries following the introduction of experience rating has been ineffective at reducing days off work for work injuries but had a displacement effect on return-to-work for people with an off-the-job injury.

7.6.4 Robustness checks

I check whether the results are robust to alternative models. The results for work claims are displayed in Table 7.6. The models displayed are the inverse hyperbolic sine

[18] I also run these regressions with injury rates as the dependent variable (see Appendix D). The R-squared values on these are low, indicating that the injury rate model is not a good fit.

transformation ($SINH^{-1}$), a Poisson quasi-maximum likelihood model (POISSON QML), a negative binomial model with the average marginal effects displayed (NBREG AME), a log-linear model in which firms with no claims are excluded from the sample (LOG-LINEAR), a log-linear model in which firms with no claims are recoded to have one claim (LOG-LINEAR2) and an ordinary least squares model (OLS). The dependent variable is the number of claims with treatment costs greater than $500 and includes the full set of controls. The coefficient on the interaction term (RF*post2011) is negative and statistically significant in most of the models.

Neither the Poisson quasi-maximum likelihood model with firm fixed effects nor the negative binomial model with firm fixed effects converged. The size of the coefficient on the interaction term (RF*post2011) using the Poisson quasi-maximum likelihood model is -0.0279 and is statistically significant.

Using the negative binomial model without fixed effects, the marginal effect of an additional unit of RF in the post-2011 period holding all other variables, including RF, at their mean value is -0.049. This implies that when all other variables are at the mean a one standard deviation increase in the rating factor is associated with a 0.049 decrease in the number of claims relative to the period before the introduction of experience rating. For a firm with the mean number of claims (1.20), this would imply a 4.1 percent decrease.

The size of the coefficient is similar across the two log-linear models. A one standard deviation increase in the rating factor is associated with a decrease in work claims with treatment costs over $500 by 0.019 log points (1.9 percent) for both log-linear models with firm fixed effects.

Using OLS with firm fixed effects, a one standard deviation increase in RF is associated with a decrease in the number of claims by 0.116. Given that the average number of claims per firm is 1.20, this would correspond to 9.7 percent decrease at the mean.

The robustness check indicates that the use of alternative models finds a larger and stronger effect of experience rating on work claims relative to the inverse hyperbolic sine transformation model.

The results for earners' claims are similar to that for work claims (see Table 7.7). All coefficients on the interaction term of interest are negative and statistically significant, apart from the Poisson quasi-maximum likelihood coefficient without firm fixed effects, which is negative, small in magnitude and not statistically significant. There is no evidence across any of the models to suggest that earners' claims increased following the introduction of experience rating.

7.7 Discussion

Despite the hypothesis that firms will respond to experience rating with both improved safety effort and increased claims management, I find no evidence that the introduction of experience rating in New Zealand led to workers claiming work injuries as occurring off-the-job. Experience rating appears to have had little impact on work claims, but some possible spillover effects in reducing off-the-job injury.

While there are several possible firm responses to experience rating that might result in a reduction in earners claims (e.g., the knowledge gained from training on the safe use of machinery is then applied to use of machinery at home), it is surprising that this would not also affect other types of claims, such as treatment-only claims. Further research could look at the types of injuries in more detail (e.g. strains and sprains compared to fractures and dislocations).

This research has some important limitations. Firstly, I am not able to directly measure firms' participation in the experience rating programme. Instead I create a proxy for participation in experience rating using available data. While these data are thought to be a reasonable proxy, future work could benefit from direct access to programme data.

Second, there have been a lot of changes to the health and safety system in New Zealand, over this period. There was the Pike River Coal Mine Disaster in 2010 in which 29 workers lost their lives, a Royal Commission inquiry into the disaster which reported back 2012, and a Taskforce review of the workplace health and safety system which made recommendations in 2013. An independent workplace health and safety regulator was established at the end of 2013 (WorkSafe New Zealand) and new health and safety legislation came into effect in 2016 (the Health and Safety at Work Act (2015)). If these events have had a stronger effect on reducing claims in firms that are more highly experience rated, then they will be contributing to the results found here.

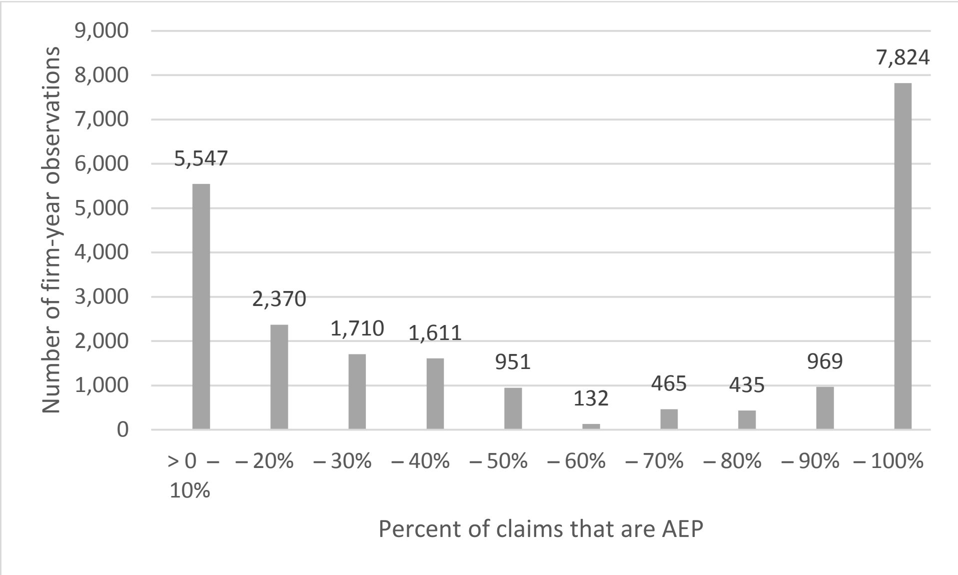
Third, this study has only looked at claims shifting; it is possible that the introduction of experience rating was associated with other claims management behaviour not studied here.

Overall, I find no evidence that experience rating has led to claims shifting behaviour in the current policy settings. The trade-offs between pooling risk and incentivising injury reduction appears to be well balanced; however, the impact on reducing work claims was also very small (and not statistically significantly different from zero in the main specification). This does not preclude a change in behaviour if incentives were to be strengthened by increasing the rating factor.

From 1 April 2014 the maximum experience rating loading was increased to 60%. With only one year of data after the introduction of this increase I was not able to look at the impact that this may have had on claims. This could be an area for future research, once additional years of claims data are added to the IDI.

7.8 Tables and Figures

Figure 7.1: Proportion of work claims that are AEP claims for firms with at least one AEP claim



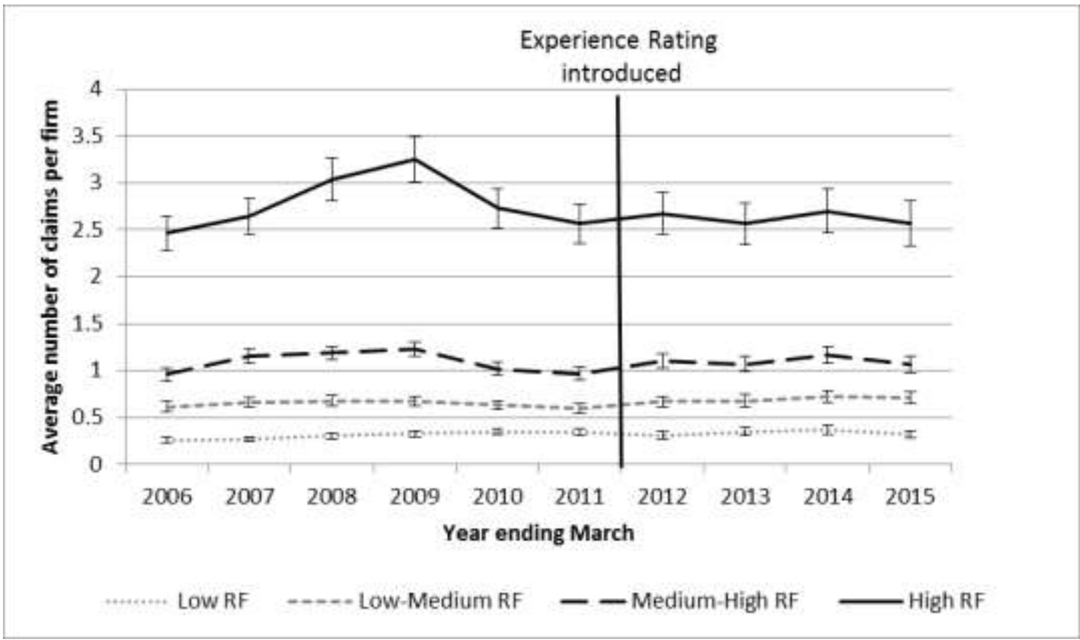
Note: 97% of firm-year observations have no AEP claims. This figure is restricted to firm-year observations for which at least one claim is labelled as an AEP claim. The proportion of claims that are AEP is calculated for each firm-year observation and the frequency is displayed for the percent of claims that are AEP in groupings of 10 percentage points. The sample includes all experience rated firms, prior to restricting the sample to firms present in at least one year in the period 2006-2010.

Table 7.1: Descriptive statistics

VARIABLE	All years: 2006-2015 Mean	Std. Dev.	Pre-experience rating: 2006-2011 Mean	Std. Dev.	Post-experience rating: 2012-2015 Mean	Std. Dev.
Work claims						
Total claims	9.14	15.79	9.33	16.40	8.81	14.65
Treatment costs <$500	1.20	2.35	1.20	2.35	1.19	2.36
Treatment only claims	7.94	13.79	8.07	14.32	7.71	12.79
Lost-time claims	1.12	2.32	1.17	2.38	1.02	2.19
Number of compensated days						
per lost-time claim	91.62	191.92	101.46	222.75	73.09	110.66
Off the job claims						
Total claims	22.83	48.91	22.48	48.38	23.43	49.82
Treatment costs <$500	3.63	8.30	3.53	8.07	3.80	8.69
Treatment only claims	20.76	45.39	20.38	44.80	21.42	46.43
Lost-time claims	1.68	3.31	1.70	3.34	1.65	3.27
Number of compensated days						
per lost-time claim	74.28	142.98	80.33	168.27	63.39	78.23
Experience rating						
Rating Factor	0.11	0.08	0.12	0.08	0.12	0.08
Liable earnings ($m)	$4.54	$10.90	$4.18	$10.10	$5.18	$12.10
Levy	$42,538	$77,840	$39,085	$71,754	$48,634	$87,237
Firm characteristics						
Number of employees (00)	0.95	2.12	93.48	213.15	97.45	209.52
% male	0.65	0.28	0.66	0.28	0.65	0.28
% aged <25	0.16	0.13	0.17	0.14	0.14	0.13
% aged 60+	0.10	0.09	0.09	0.09	0.12	0.10
Part of a multi-site enterprise	0.26	0.44	0.25	0.44	0.26	0.44
Employee Turnover	0.13	0.11	0.14	0.11	0.12	0.11
Monthly gross earnings	3650.28	1501.09	3296.61	1312.56	4274.64	1606.04
% earning $10,000 or more	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
% earning $5-10,000	0.18	0.16	0.14	0.13	0.26	0.17
% earning $2-$5,000	0.55	0.18	0.57	0.19	0.52	0.17

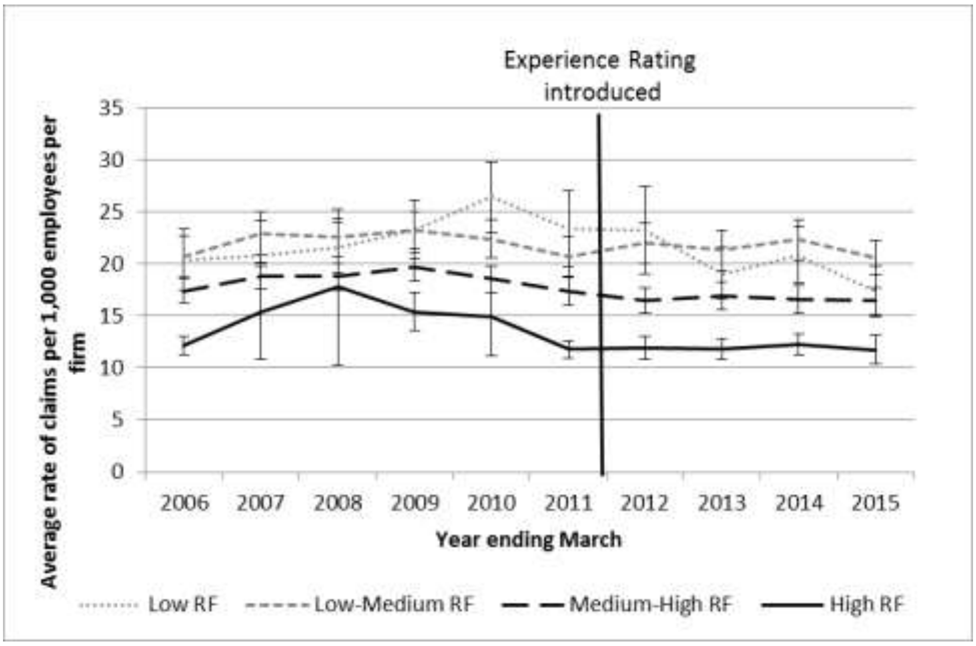
% earning $1- $2,000	0.12	0.11	0.14	0.11	0.09	0.09
% earning less than $1,000	0.12	0.14	0.14	0.15	0.09	0.12
Enterprise age since 2000	10.81	2.93	9.17	1.80	13.70	2.21
Observations						
All	49,722		31,755		17,970	
Work claims with days off	23,118		15,096		8,022	
Earners' claims with days off	28,704		18,441		10,263	

Figure 7.2: Average number of work claims with treatment costs over $500 per firm by treatment intensity group



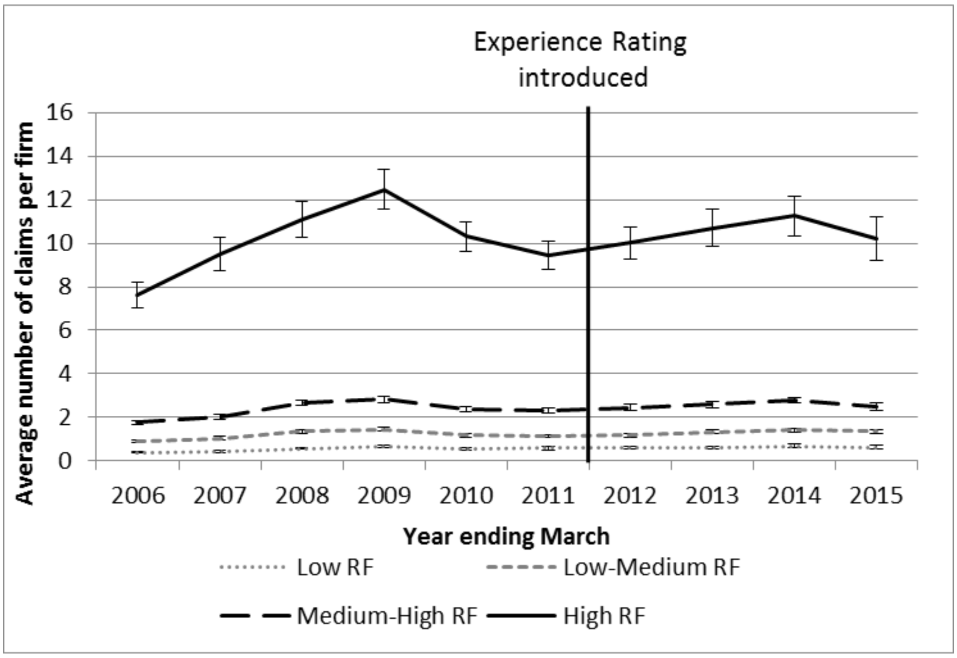
Note: Error bars represent 95% confidence intervals. Four treatment intensity groups have been created for descriptive purposes. Low RF groups together firms with the lowest quartile treatment intensity; high RF groups together firms with the highest quartile of treatment intensity.

Figure 7.3: Average rate of work claims with treatment costs overs $500 per 1,000 employees per firm by treatment intensity group



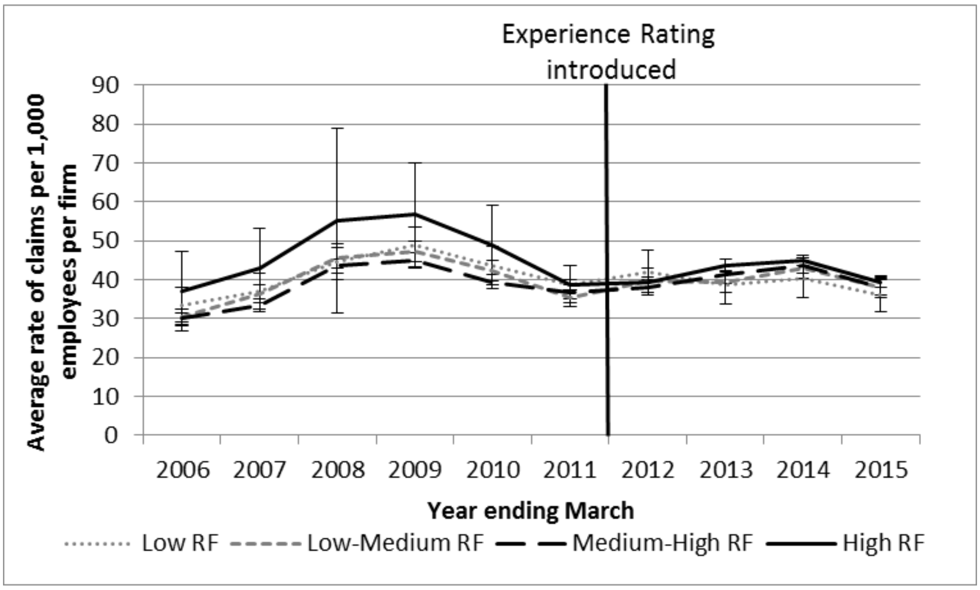
Note: Error bars represent 95% confidence intervals. Four treatment intensity groups have been created. Low RF groups together firms with the lowest quartile treatment intensity; high RF groups together firms with the highest quartile of treatment intensity.

Figure 7.4: Average number of earners' claims with treatment costs over $500 per firm by treatment intensity group



Note: Error bars represent 95% confidence intervals. Four treatment intensity groups have been created. Low RF groups together firms with the lowest quartile treatment intensity; high RF groups together firms with the highest quartile of treatment intensity.

Figure 7.5: Average rate of earners' claims with treatment costs overs $500 per 1,000 employees per firm by treatment intensity group



Note: Error bars represent 95% confidence intervals. Four treatment intensity groups have been created. Low RF groups together firms with the lowest quartile treatment intensity; high RF groups together firms with the highest quartile of treatment intensity.

Table 7.2: Inverse hyperbolic sine regressions predicting claims with costs of treatment greater than $500 to test for parallel trends in the pre-treatment period (2006-2011)

Sample:	**Work Claims**		**Earners' Claims**	
VARIABLES	(1)	(2)	(3)	(4)
Dependent variable: Number of claims with treatment costs greater than $500				
RF*Time trend	0.00463**	0.00127	0.00751***	0.00686***
	(0.00232)	(0.00217)	(0.00201)	(0.00194)
RF	0.316***		0.729***	
	(0.0193)		(0.0205)	
Constant	-1.683***	0.0759	-0.207	0.477***
	(0.266)	(0.163)	(0.160)	(0.175)
Controls				
Firm characteristics	Yes	Yes	Yes	Yes
Employees squared	Yes	Yes	Yes	Yes
Industry level 2	Yes		Yes	
Firm fixed effects		Yes		Yes
R-squared	0.390	0.030	0.661	0.080
Observations	31,755	31,755	31,755	31,755
Number of firms		7,824		7,824
Mean dependent variable	0.6834	0.6834	1.2564	1.2564
Dependent variable: Rate of claims with treatment costs greater than $500 per 1,000 employees				
RF*Time trend	0.00653	-0.00009	-0.00490	-0.00357
	(0.00495)	(0.00490)	(0.00502)	(0.00488)
RF	0.648***		0.979***	
	(0.0290)		(0.0325)	
Constant	-2.278***	1.359**	1.187***	2.346***
	(0.557)	(0.597)	(0.404)	(0.648)
Controls				
Firm characteristics	Yes	Yes	Yes	Yes
Employees squared				
Industry level 2	Yes		Yes	
Firm fixed effects		Yes		Yes
R-squared	0.121	0.003	0.175	0.017
Observations	31,755	31,755	31,755	31,755
Number of firms		7,824		7,824
Mean dependent variable	1.9682	1.9682	3.1460	3.1460

Note: These regressions include controls for firm characteristics and year fixed effects. Columns 1 and 3 include detailed industry fixed effects (level 2). Columns 2 and 4 include firm fixed effects but exclude industry. When the dependent variable is the number of claims it includes controls for number of employees and its quadratic. When the dependent variable is the rate of claims per 1,000 employees, it includes controls for the number of employees but not the quadratic.

*** p<0.01, ** p<0.05, * p<0.1

Table 7.3: Placebo test: Inverse hyperbolic sine regression predicting number of claims with treatment costs greater than $500 in the pre-treatment period

Sample:	**Work Claims**			**Earners' Claims**		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Number of claims with treatment costs greater than $500						
RF*Post2007	0.052***			0.060***		
	(0.0113)			(0.0091)		
RF*Post2008		0.036***			0.039***	
		(0.0124)			(0.0101)	
RF*Post2009			-0.057***			-0.066***
			(0.0116)			(0.0092)
Constant	0.0796	0.0731	0.0813	0.481***	0.474***	0.474***
	(0.162)	(0.163)	(0.162)	(0.174)	(0.175)	(0.175)
Controls						
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Employees squared	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.031	0.031	0.031	0.081	0.080	0.080
Observations	31,755	31,755	31,755	31,755	31,755	31,755
Number of firms	7,824	7,824	7,824	7,824	7,824	7,824
Mean dep var	0.6834	0.6834	0.6834	1.2564	1.2564	1.2564
Dependent variable: Rate of claims with treatment costs greater than $500 per 1,000 employees						
RF*Post2007	0.065**			-0.070**		
	(0.0276)			(0.0278)		
RF*Post2008		0.026			-0.010	
		(0.0300)			(0.0294)	
RF*Post2009			-0.083***			0.084***
			(0.0284)			(0.0277)
Constant	1.36**	1.36**	1.37**	2.34***	2.35***	2.34***
	(0.597)	(0.597)	(0.596)	(0.649)	(0.648)	(0.649)
Controls						
Firm characteristics	Yes	Yes	Yes			
Firm fixed effects	Yes	Yes	Yes			
R-squared	0.003	0.003	0.004	0.017	0.017	0.017
Observations	31,755	31,755	31,755	31,755	31,755	31,755
Number of firms	7,824	7,824	7,824	7,824	7,824	7,824
Mean dep variable	1.9682	1.9682	1.9682	3.1460	3.1460	3.1460

Note: These regressions include controls for firm characteristics, year fixed effects and firm fixed effects. When the dependent variable is the number of claims it includes controls for number of employees and its quadratic. When the dependent variable is the rate of claims per 1,000 employees, it includes controls for the number of employees but not the quadratic.

**** $p<0.01$, ** $p<0.05$, * $p<0.1$*

Table 7.4: Inverse hyperbolic sine linear regression of firms predicting the number of injury claims with treatment costs over $500

Sample:	**Work Claims**				**Earners' Claims**			
VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Number of claims with treatment costs greater than $500 ($SINH^{-1}$)								
RF*Post2011	-0.0292***	-0.0182**	-0.0208***	-0.0156	-0.0212***	-0.0182***	-0.00823	-0.0318***
	(0.00785)	(0.00745)	(0.00614)	(0.00970)	(0.00762)	(0.00704)	(0.00544)	(0.00762)
RF	0.172***	0.270***			0.682***	0.670***		
	(0.0187)	(0.0188)			(0.0216)	(0.0223)		
RF*Time trend				-0.00109				0.00501***
				(0.00182)				(0.00158)
Employees (hundreds)	0.221***	0.196***	0.342***	0.342***	0.197***	0.166***	0.455***	0.455***
	(0.0198)	(0.0199)	(0.0220)	(0.0220)	(0.0260)	(0.0246)	(0.0285)	(0.0286)
Employees squared	-0.00004***	-0.00004***	-0.00006***	-0.00006***	-0.00005***	-0.00004***	-0.00009***	-0.00009***
	(0.000008)	(0.000007)	(0.00001)	(0.00001)	(0.00001)	(0.000009)	(0.00001)	(0.000001)
Multi-site firm		0.0599***	0.0986***	0.0985***		0.145***	0.147***	0.148***
		(0.0146)	(0.0224)	(0.0224)		(0.0148)	(0.0248)	(0.0248)
Employee turnover		0.000551	-0.000464	-0.000466		-0.00169***	-0.000594	-0.000584
		(0.000394)	(0.000327)	(0.000327)		(0.000419)	(0.000362)	(0.000362)
Monthly earning >$10,000+								
% earning $5-$10,000		0.0129***	0.00268***	0.00262***		0.00360***	-0.000569	-0.000295
		(0.00181)	(0.000950)	(0.000951)		(0.00123)	(0.00103)	(0.00102)
% earning $2-$5,000		0.0151***	0.00246***	0.00239***		0.00293***	-0.00105	-0.000753
		(0.00163)	(0.000900)	(0.000903)		(0.00113)	(0.000970)	(0.000970)
% earning $1-$2,000		0.0185***	0.00398***	0.00393***		0.00437***	0.000862	0.00108
		(0.00174)	(0.00103)	(0.00103)		(0.00127)	(0.00114)	(0.00113)
% earning <$1,000		0.0169***	0.00304***	0.00298***		0.00482***	-0.00197*	-0.00168
		(0.00165)	(0.00104)	(0.00105)		(0.00128)	(0.00119)	(0.00118)
% Male		0.00588***	0.00153***	0.00153***		0.000506	0.00123***	0.00123***
		(0.000336)	(0.000299)	(0.000299)		(0.000309)	(0.000373)	(0.000373)
% Aged<=25		0.000261	0.00110***	0.00110***		0.00446***	0.00237***	0.00237***
		(0.000532)	(0.000397)	(0.000397)		(0.000485)	(0.000472)	(0.000472)
% Aged>60		-0.00144***	-0.000724*	-0.000730*		-0.00316***	-0.00215***	-0.00213***
		(0.000412)	(0.000430)	(0.000430)		(0.000492)	(0.000521)	(0.000521)
Enterprise Age <=5 years								
5-10 years		-0.000208	-0.000749	-0.000727		0.0159	0.0215	0.0214
		(0.0262)	(0.0269)	(0.0269)		(0.0289)	(0.0275)	(0.0275)
10-15 years		0.00908	0.0180	0.0183		0.0322	0.0246	0.0234
		(0.0304)	(0.0331)	(0.0331)		(0.0332)	(0.0335)	(0.0335)

>15 years		-0.0119	-0.0134	-0.0128		-0.0168	-0.0116	-0.0141
		(0.0395)	(0.0416)	(0.0416)		(0.0442)	(0.0428)	(0.0428)
Enterprise size (firm=enterprise)								
Small		-0.104***	-0.0736***	-0.0736***		-0.171***	-0.143***	-0.143***
		(0.0135)	(0.0256)	(0.0256)		(0.0160)	(0.0296)	(0.0296)
Medium low		0.0110	-0.0463*	-0.0465*		-0.0758***	-0.0321	-0.0315
		(0.0155)	(0.0271)	(0.0271)		(0.0163)	(0.0276)	(0.0276)
Medium high		0.0898***	0.0246	0.0243		-6.06e-05	0.0853**	0.0869**
		(0.0201)	(0.0337)	(0.0338)		(0.0200)	(0.0339)	(0.0339)
Large		0.0252	0.000774	0.000562		-0.0641***	0.0339	0.0349
		(0.0240)	(0.0445)	(0.0445)		(0.0230)	(0.0494)	(0.0495)
Constant	0.467***	-1.390***	-0.0310	-0.0252	0.932***	0.306**	0.658***	0.631***
	(0.0174)	(0.162)	(0.101)	(0.102)	(0.0209)	(0.121)	(0.111)	(0.111)
Controls								
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Level 2		Yes				Yes		
Firm fixed effects			Yes	Yes			Yes	Yes
R-squared	0.301	0.385	0.042	0.042	0.625	0.650	0.080	0.080
Observations	49,722	49,722	49,722	49,722	49,722	49,722	49,722	49,722
Number of firms			7,821	7,821			7,821	7,821
Mean dependent variable	0.6838	0.6838	0.6838	0.6838	1.2791	1.2791	1.2791	1.2791

Note: This table displays the results of an inverse hyperbolic sine linear regression looking at whether the degree of experience rating (RF) is associated with the number of injury claims following the introduction of experience rating (post2011). The coefficients for the interaction terms are displayed, along with that for RF. Additional controls are displayed at the end.

*** p<0.01, ** p<0.05, * p<0.1

Table 7.5: Inverse hyperbolic sine linear regression predicting the number of claims for firms by type of claim

	Work Claims				Earners' Claims			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	*Number of treatment only claims*	*Total number of claims*	*Number of weekly comp. claims*	*Average days off work*	*Number of treatment only claims*	*Total number of claims*	*Number of weekly comp. claims*	*Average days off work*
WITH FIRM FIXED EFFECTS								
RF*Post2011	0.00429	0.00601	0.00971	0.00350	0.00517	0.00589	0.00438	0.0511***
	(0.00807)	(0.00799)	(0.00957)	(0.0297)	(0.00739)	(0.00732)	(0.00914)	(0.0192)
RF*Time trend	-0.00747***	-0.0077***	-0.00948***	-0.0102*	-0.00175	-0.00176	-0.00483***	-0.0176***
	(0.00174)	(0.00174)	(0.00177)	(0.00533)	(0.00164)	(0.00163)	(0.00167)	(0.00348)
Constant	0.927***	1.033***	0.299***	3.882***	2.351***	2.417***	0.204*	3.857***
	(0.142)	(0.142)	(0.0951)	(0.678)	(0.135)	(0.134)	(0.107)	(0.396)
R-squared	0.105	0.117	0.054	0.009	0.121	0.130	0.060	0.006
WITHOUT FIRM FIXED EFFECTS								
RF*Post2011	-0.0199**	-0.0189*	-0.00634	-0.00340	-0.00977	-0.00956	-0.00233	0.0616***
	(0.00995)	(0.00997)	(0.0105)	(0.0274)	(0.00882)	(0.00881)	(0.00976)	(0.0186)
RF*Time trend	-0.00350	-0.00337	-0.00615***	-0.0102**	-0.00346	-0.00336	-0.00371**	-0.0183***
	(0.00235)	(0.00238)	(0.00216)	(0.00479)	(0.00215)	(0.00216)	(0.00188)	(0.00327)
RF	0.674***	0.686***	0.237***	0.130***	0.985***	0.990***	0.405***	0.146***
	(0.0275)	(0.0278)	(0.0219)	(0.0247)	(0.0260)	(0.0260)	(0.0233)	(0.0181)
Constant	-1.795***	-1.861***	-1.647***	4.010***	1.460***	1.396***	-1.572***	3.225***
	(0.235)	(0.243)	(0.175)	(0.353)	(0.163)	(0.165)	(0.143)	(0.228)
R-squared	0.585	0.597	0.329	0.025	0.718	0.719	0.493	0.023
Controls								
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employees squared	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,722	49,722	49,722	23,118	49,722	49,722	49,722	28,704
Number of firms	7,824	7,824	7,824	6,012	7,824	7,824	7,824	6,549
Mean dependent variable	2.0856	2.2183	0.6315	4.3819	2.8418	2.9524	0.8548	4.4071

Note: Each column represents a separate regression with a different dependent variable. The first group of columns is based on work claims while the second group of columns is based on off-the-job claims for workers. The dependent variable for columns 4 and 8 are the average number of days off work per weekly compensation claim per firm. "Weekly comp." (columns 3 and 7) stands for weekly compensation.

*** p<0.01, ** p<0.05, * p<0.1

Table 7.6: Model comparison of predictions of the impact of experience rating on work claims with treatment costs over $500

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
MODEL:	SINH^{-1}	POISSON QML	NBREG AME	LOG-LINEAR	LOG-LINEAR 2	OLS
Dependent variable: Number of work claims with treatment costs over $500						
WITH FIRM FIXED EFFECTS						
RF*Post2011	-0.0156			-0.0194*	-0.0190**	-0.116***
	(0.00970)	*Too many*	*Does not*	(0.0117)	(0.00777)	(0.0389)
RF*Time trend	-0.00109	*variables*	*converge*	-0.000034	-0.000231	0.00739
	(0.00182)			(0.00220)	(0.00148)	(0.00734)
Constant	-0.0252			-0.449*	-0.165**	-0.663**
	(0.102)			(0.257)	(0.0673)	(0.268)
R-squared	0.042			0.052	0.052	0.117
WITHOUT FIRM FIXED EFFECTS						
RF*Post2011	-0.0267***	-0.0279***	-0.0490**	-0.0278**	-0.0262***	-0.180***
	(0.0101)	(0.0101)	(0.0229)	(0.0121)	(0.00817)	(0.0434)
RF*Time trend	0.00171	0.00394	0.00559	0.000954	0.00167	0.0194**
	(0.00202)	(0.00396)	(0.00562)	(0.00239)	(0.00164)	(0.00923)
RF	0.264***	0.534***	0.867***	0.185***	0.109***	0.0953
	(0.0214)	(0.0606)	(0.0569)	(0.0224)	(0.0174)	(0.0929)
Constant	-1.393***	-4.867***		-2.004***	-1.079***	-3.321***
	(0.163)	(1.524)		(0.345)	(0.127)	(0.844)
R-squared	0.385	0.421		0.378	0.391	0.481
Controls						
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,722	49,722	49,722	25,167	49,722	49,722
Mean dependent variable	0.0684	1.2007	1.2007	0.5324	0.2695	1.2007

Note: This table compares the results for work claims from the six different models. Two version of log-linear are used, in the first model firms with no claims are dropped from the sample, in the second they are assigned a claims value of one.

*** p<0.01, ** p<0.05, * p<0.1

Table 7.7: Model comparison of predictions of the impact of experience rating on earners' claims with treatment costs over $500

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
MODEL:	$SINH^{-1}$	POISSON QML	NBREG AME	LOG-LINEAR	LOG-LINEAR 2	OLS
WITH FIRM FIXED EFFECTS						
Dependent variable: Number of earners' claims with treatment costs over $500						
RF*Post2011	-0.0318***	*Too many*	*Does not*	-0.0239***	-0.0392***	-0.712***
			converge	(0.00810)		
	(0.00762)	*variables*			(0.00647)	(0.100)
RF*Time trend	0.00501***			0.00265	0.00705***	0.196***
	(0.00158)			(0.00168)	(0.00138)	(0.0225)
Constant	0.631***			0.277	0.152*	-0.245
	(0.111)			(0.189)	(0.0871)	(0.633)
R-squared	0.080			0.099	0.099	0.489
WITHOUT FIRM FIXED EFFECTS						
Dependent variable: Number of earners' claims with treatment costs over $500						
RF*Post2011	-0.0418***	-0.000968	-0.175**	-0.0372***	-0.0455***	-0.697***
	(0.00817)	(0.00710)	(0.0740)	(0.00847)	(0.00691)	(0.110)
RF*Time trend	0.00476**	-0.00381	0.00675	0.476***	0.00673***	0.190***
	(0.00187)	(0.00245)	(0.0172)	(0.0254)	(0.00165)	(0.0236)
RF	0.653***	0.584***	4.084***	0.00279	0.482***	-0.00570
	(0.0247)	(0.0538)	(0.370)	(0.00193)	(0.0242)	(0.231)
Constant	0.297**	-1.033***		-0.0648	0.00747	0.559
	(0.121)	(0.338)		(0.142)	(0.0996)	(0.769)
R-squared	0.650	0.621		0.653	0.687	0.852
Controls						
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,722	49,722	49,722	35,298	49,722	49,722
Mean dependent variable	1.2791	3.6362	3.6362	1.0256	0.7380	3.6362

Note: This table compares the results for earners' claims from the six different models. Two version of log-linear are used, in the first model firms with no claims are dropped from the sample, in the second they are assigned a claims value of one.

*** p<0.01, ** p<0.05, * p<0.1

Chapter 8

What's up with Mondays? An investigation into the "Monday Effect" for on- and off-the-job injury claims

8.1 Introduction

The results from the previous chapter provide some reassurance that the New Zealand ACC system is robust to the threat of claims shifting following the introduction of experience rating. This chapter turns to a different topic of claiming behaviour – that of the "Monday Effect".

Research in other countries consistently finds a higher number of injuries on a Monday (Brogmus, 2007; Richard J. Butler et al., 1996; B. Hansen, 2016; Smith, 1990; Wigglesworth, 2006). A common hypothesis is that excess Monday claims are the result of people injured off-the-job in the weekend claiming that their injuries occurred on-the-job on the Monday to receive workers' compensation benefits (B. Hansen, 2016; Smith, 1990). This is known in the literature as the 'moral hazard hypothesis'. The worker knows where, when and how the injury occurred, but this is not observed by the insurer. I test this using data from New Zealand, where compensation is identical for both types of injuries, so in principle there should not be the same incentives to claim weekend off-the-job injuries as happening at work on the Monday.

As mentioned in section 3.11, one of the early proponents of this hypothesis for the Monday Effect, Smith (1990), theorises that if people fraudulently claim weekend injuries as happening at work on the Monday then: (1) injuries that are easy to conceal and for which treatment can be easily delayed will be overrepresented on a Monday; (2) the injuries will be recorded as occurring earlier in the day on a Monday because people would seek treatment as soon as they could reasonably do so without arousing suspicion; and (3) the effect will be stronger on a Tuesday after a Monday public holiday because there had been a longer length of time possible for off-the-job injuries to occur.

8.2 Economic Theory

8.2.1 Fraudulent claims and the Monday Effect

This section outlines the economic theory behind the fraudulent claims theory for the Monday Effect.

Stage 1: Injury risk

The probability of an injury on a given day of the week depends on the risk profile of activities undertaken and the exposure to those risks. For example, when a public holiday falls on a Monday, the average worker will have a longer period of 'weekend' exposure to off-the-job injury risk. Tuesdays after a public holiday Monday can be thought to be similar to Mondays in this sense.

$$\mathrm{P(injury)} = \mathrm{Risk\ x\ Exposure} \tag{8.1}$$

Stage 2: Whether to falsely claim that an injury happened at work

As described in chapter 4, workers who have an injury have three options:

1. Obtain treatment and make a workers' compensation claim.
2. Do not have the injury treated and continue to work.
3. Obtain treatment for the injury but do not make a workers' compensation claim.

These options have the following payouts:

$$E\mathrm{U(e,f)} = \begin{cases} \big(1-p(e)\big)\big(u(W)-\xi\big)+p(e)\big[\gamma(f)u(B)+\big(1-\gamma(f)\big)u(D)-c(h,f)\big]-c(e) & \text{work} \\ u(W)-\xi-p(e)n-c(e) & \text{not treated} \\ \big(1-p(e)\big)\big(u(W)-\xi\big)+p(e)\big[u(D)-c(h)\big]-c(e) & \text{leisure} \end{cases} \tag{8.2}$$

where e is the level of safety effort, and f is the effort required to prove that an injury is work-related. In the following discussion I assume that workers maximise expected utility.

If an off-the-job injury has occurred in the weekend, claiming it as a work injury on the Monday would involve disutility associated with delaying treatment, r.

$$\mathrm{EU}(\text{seek treatment, falsely claim}) = \gamma(f)u(B) + \big(1-\gamma(f)\big)u(D) - c(h,f) - r \tag{8.3}$$

If the worker chooses to be treated, he or she will choose to falsely claim that the injury happened at work if the following holds:

$$\gamma(f)u(B) - c(h,f) - r > \gamma(f)u(D) - c(h) \tag{8.4}$$

The likelihood that the injury is accepted as work-related (γ) and the cost of delaying treatment (r) will vary by injury type. For example, it would be difficult to delay treatment for an amputated arm and it would be difficult to conceal the injury from colleagues at the start of the work day on the Monday. Alternatively, it would be much easier to delay treatment for a sprain and colleagues are less likely to observe the injury. If there are fraudulent claims then we would expect to see a larger Monday Effect for injuries that are easier to conceal (higher γ) and less costly to delay treatment for (lower r), such as strains and sprains.

Statement 8.4 is also more likely to hold when B is much greater than D. Consider three scenarios. In the first scenario, the costs of off-the-job injury are private, such that $\mathrm{D} = 0$. In the second, there is a fully funded public healthcare system but there is no coverage for lost wages ($0 < \mathrm{D} < \mathrm{B}$). In the third, there is a universal injury compensation environment where all costs are fully covered for off-the-job injury ($0 < \mathrm{D} = \mathrm{B}$). I assume that each scenario has a fully funded workers' compensation scheme and for simplicity I assume that there is no private health insurance. Broadly speaking, the US is comparable to scenario one, Canada to scenario 2 and New Zealand to scenario three (see section 2.6). If fraudulent claims cause the Monday Effect, one would expect the size to be largest in scenario one and smallest in scenario three.[19]

Proposition 1: If fraudulent claims cause the Monday Effect, there will be no Monday Effect in the New Zealand work claims or the off-the-job claims.

Card and McCall (1996) produce an estimate of the Monday Effect for the US. They observe that those with private health insurance will face weaker incentives (scenario two or three relative to scenario one). They compare these scenarios by interacting the Monday Effect with a variable indicating whether the person is likely to have private health insurance. They fail to find any difference.

Campolieti and Hyatt (2006) produce a comparison between scenario one and scenario two by estimating the Monday Effect in Canada and comparing it to the overall estimate produced by Card and McCall (1996) for the US. They find a Monday Effect that is of a similar magnitude to the US suggesting that if fraudulent claims are causing the Monday Effect it is through the wage replacement rather than the treatment costs. In this chapter, I use the same method as Campolieti and Hyatt (2006) to produce an estimate of scenario three using data from New Zealand.

8.2.2 Alternative theories

There are several alternative theories for the Monday Effect. I consider each of these through the lens of whether the theory is work-specific or whether it might be expected to apply to other types of injuries such as off-the-job and non-earner injury.

[19] Although in the presence of perfect information there would be no Monday Effect in the third scenario, people are not always aware of their eligibility (see section 3.5.1) so a Monday Effect may remain.

The first alternative theory is that the Monday Effect is caused by job dissatisfaction on a Monday. This may have a physiological explanation as job dissatisfaction has been linked to pain (Hoogendoorn, van Poppel, Bongers, Koes, & Bouter, 2000) or it may be caused by people fraudulently claiming that they have had an injury to avoid being at work (Richard J Butler et al., 2014). This explanation could also apply to off-the-job injury in a universal claims environment, with people claiming to have injured themselves before work to avoid going in on the Monday; however, the effect would not be as strong as it would be in a workers' compensation environment because they could also say that they injured themselves on the Sunday. Since the injury is prompted by job dissatisfaction I would expect the injury to be of a type that is harder to diagnose, such as sprains and strains and back injuries (Richard J. Butler et al., 1996; Dionne & St-Michel, 1991; Smith, 1990) and to involve fewer days off work because it seems it would be easier to fake a minor injury than a major injury.

In this case the disutility from working, ξ, varies by day of the week, η_d, where $0 < \eta \leq 1$ and η on a Monday is greater than η on other days of the week. This decreases the utility associated not getting treatment on a Monday relative to other days of the week.

$$u(\text{no treatment}|\text{injury}) = u(W) - \eta_d * \xi - \text{n} \tag{8.5}$$

Proposition 2: If the job dissatisfaction explanation applies, there will be a Monday Effect for injury in New Zealand, for work injury and off-the-job injury. Monday injuries will have a higher proportion of strains and sprains and back injuries and be less serious than injuries on other days of the week.

The next alternative theory is that after a weekend off work people are more susceptible to strains and sprains and back injuries because they need time to warm up at work. In this case, the risk variable in equation 8.1 varies by day of the week, d, and the type of injury, j, where η is larger for strains on a Monday. A higher number of strains on a Monday will lead to a higher number of injury claims for strains on a Monday, everything else held constant. The value of η is constant for off-the-job injury.

$$p(injury_j) = \eta_{dj} Risk * Exposure \tag{8.6}$$

Proposition 3: If the physiological explanation is correct then there will be a Monday Effect in New Zealand, for work injury and off-the-job injury, with more sprains and strains and back injuries.

Another alternative theory is that people are exposed to higher levels of *work* injury risk on a Monday. For example, there may be less supervision owing to management team meetings on a Monday; a backload of work from the weekend contributing to higher stress; or a tendency to tackle more difficult tasks earlier in the week. In this case the value of η varies by the day of the week but not the injury type for work injury and it takes a constant value for off-the-job injury.

$$p(work\ injury_j) = \eta_d Risk * Exposure \tag{8.7}$$

Proposition 4: If there is higher work injury risk on a Monday, there will be a Monday Effect in New Zealand, for work injury but not for off-the-job injury. There is not necessarily any pattern in the type of injury or in the seriousness of the injury.

The final alternative theory discussed here is that people are generally exposed to higher levels of *any* injury risk on a Monday than other weekdays. For example, this may be caused by impairment owing to drugs, alcohol or fatigue following a weekend of parties or late nights. In this case η is higher on a Monday for both work and off-the-job injury.

$$p(injury_j) = \eta_d Risk * Exposure \tag{8.8}$$

Proposition 5: If there is higher injury risk on a Monday, there will be a Monday Effect for work injury, off-the-job injury and non-earners' injury. There is not necessarily any pattern to the type of injury or the seriousness of the injury.

8.3 Data

I use New Zealand injury claims data from the IDI to look at whether there is a Monday Effect in the work account (work injury), earners' account (off-the-job injury for workers) and non-earners' account (nonearners' injury) to evaluate the five propositions described in the previous section. The data cover the calendar years 2002 to 2015. I exclude gradual process injury because, by definition, these types of injuries do not have an accident date. I exclude the two weeks of every year that include Christmas day and New Year's Day because a lot of workplaces in New Zealand close for the summer holidays over this period.

8.3.1 Variables

Day of the week

The day of the week is based on the accident date (as distinct from the treatment date or the claim acceptance date). This information is usually recorded by the doctor following a discussion with the patient about when the injury happened and how it happened (lost-time injury, which is the focus here, requires a doctor visit). To be eligible for compensation, an injury needs to be caused by a specific incident, so all accepted injury claims will have an accident date.[20]

Injury type

Injuries are grouped into seven injury type categories: sprains and strains; cuts and lacerations; contusions; fractures; burns; dislocations; and other. Claims are assigned to injury type based on the first two digits of the read code of the primary diagnosis (read codes are a standard injury classification system). See Table 8.1 for details.

Back injuries

The indicator for back injuries is derived from the body part of the primary injury. Unlike the rest of the data, information on the body part injured is available only for injuries from 2015 onwards.

Age and ethnicity

Age is estimated to the nearest year. Ethnicity is recorded using single and combined response as described in section 5.6. For example, if a person reports that he is Māori and NZ European he is coded to a 'Māori and New Zealand European' category. Where the number of observations with an ethnicity combination is fewer than 100, the individuals are coded to an 'Other' category.

Number of compensated days off work

This is the number of days for which ACC have paid weekly compensation for time off work. Here, as in Campolieti and Hyatt (2006), it is used as a proxy for the seriousness of the injury.

[20] The IDI does not include data on the time the injury occurred although this information is collected by ACC and may be added to the IDI in future.

Average weekly benefits

Consistent with Campolieti and Hyatt (2006), I include a measure of average weekly benefits. This is derived by dividing the total loss of earnings compensation received by the number of compensation days and multiplying it by five for a five-day working week. Since loss of earnings compensation is 80% of wages, this acts as a rough proxy for weekly wages, although the amount will be much smaller for part-time workers than full-time workers.

Using this method, some people have weekly gross benefits that seem implausibly high. There is a maximum on the amount of weekly compensation earnings that can be received, and some people appear to have weekly gross benefits higher than the maximum. In some instances, this could be because they only receive compensation for a few days per week (partly returned-to-work) so the actual amount received per week is lower than this derived amount. Even allowing for this though, some of the amounts still appear to be unreasonably high. To address this, I assume that if the average daily gross benefit for a claim is higher than the weekly maximum then it is an error, so I code it to missing. If the daily gross benefit amount is lower than the weekly cap, but the weekly gross benefit amount is higher than the weekly cap, I cap weekly earnings at the $1,908.50.[21] This resulted in 729 claims being capped and 31 coded to missing.

8.3.2 Descriptive statistics

Figure 8.1 displays the distribution of lost-time injuries by the day of the work week for workers for both work injury and off-the-job injury. As found elsewhere, the highest proportion of on-the-job injuries occur on a Monday (21.0%), with the lowest proportion

[21] This is the 2016 cap. Information on the cap for the all the years in the data is not available, so I apply this maximum to all years. https://www.acc.co.nz/about-us/news-media/latest-news/client-payments-changes/

happening on a Friday (18.1%) (Campolieti & Hyatt, 2006; Card & McCall, 1996). This is equivalent to an excess of 283 lost-time work claims per year. The difference in the proportion of claims on a Monday compared to the proportion on a Tuesday or Wednesday is not statistically significantly different; indicating that there are more injuries at the start of the week.

For off-the-job injury, the highest proportion of injuries occurred on a Friday (21.8%), possibly alcohol-induced, with the second-highest number occurring on a Monday (20.5%).

Figure 8.2 displays the same information but for all days of the week for comparison. As expected, most off-the-job injuries occur on the weekend. Figure 8.3 displays the weekday patterns for all injury claims (not just the lost-time injury subsample) while Figure 8.4 displays the full day of the week pattern for all injury claims. Including all claims does not change the pattern for work injury.

Table 8.2 displays the mean lost-time injury claim characteristics by whether the injury occurred on-the-job or off-the-job for: the full sample of workers; Monday injuries; and Tuesday to Friday injuries.

The average number of compensated days for work injury (99.5) is higher than that found in other countries because injuries with less than a week off work are excluded here.[22] The average number of compensated days for a work injury is 98.8 on a Monday and 99.7 on other weekdays. The values are slightly lower for off-the-job injury – 81.4 on a Monday and 83.5 on other weekdays.

Sprains and strains made up 38.7% of on-the-job injuries on a Monday compared to 37.3% on other weekdays. There is a similar day-of-the-week difference for off-the-job

[22] ACC starts paying weekly compensation one week from the day of the first doctor visit for treatment. There is no information available in the claims data for time off work if the person requires less than a week off.

injuries with 37.5% of these being strains and sprains on a Monday compared to 35.2% on other weekdays. Data on the body part injured was only available for injuries from 2015 onwards so there are fewer observations for this injury type. The proportion of back injuries, both on- and off-the-job, were higher on Mondays than other weekdays (33.2% on a Monday compared to 29.3% on other weekdays for work injury; 16.4% on a Monday compared to 13.2% on other weekday for off-the-job injury).

8.4 Empirical Strategy

I start by estimating the proportion of injuries on a Monday and, in order to compare my results from a universal claims environment (scenario three) to results from a workers' compensation claims environment with free public healthcare (Campolieti & Hyatt, 2006) and one without (Card & McCall, 1996).

There is not good data on hours worked by day of the week in New Zealand, so I am unable to analyse injury rates by day of the week. New Zealand Time Use Survey data indicate that the highest number of hours worked on average, occurs on a Tuesday (7.9 hours) and the lowest on a Friday (7.5 hours), with 19.1 percent of all paid weekday work time occurring on a Monday (Callister & Dixon, 2001). About 63 percent of workers in New Zealand, usually work all hours at standard times (between 7am and 7pm Monday to Friday) (Statistics New Zealand, 2008) and Retail Trade and Agriculture, Forestry and Fishing industries have a higher proportion of people working in the weekend (Callister & Dixon, 2001).

Consistent with the previous studies (Campolieti & Hyatt, 2006; Card & McCall, 1996), I exclude claims for injuries that occur on the weekend, restricting analysis to the typical Monday to Friday working week. I use one-sided *t*-tests to assess whether there is a higher than expected proportion of work injuries on a Monday (greater than 20 percent) and whether this varies by type of injury (proposition one and two). This assumes that people work the same number of hours per day on average, Monday to Friday. Given that the Time Use Survey data indicate that people work slightly less than 20 percent of weekly hours on a Monday, any estimate of injury above 20 percent on a Monday will be a lower bound estimate of the Monday Effect.

For the comparison with the US and Canada I restrict the claims data to lost-time injury for two reasons: (1) to improve comparison of results; and (2) because the claims information for lost-time injuries is more accurate. Where only medical fees are paid out, ACC verifies only the most relevant information (Statistics New Zealand, 2015).

I then conduct a series of linear regressions to test whether particular types of injuries are overrepresented on a Monday after controlling for other characteristics. For this part of the analysis, Tuesdays after a public holiday Monday are included in the Monday variable because they are the first day back at work after several days off. I run the regression separately for each injury type, and separately for work and off-the-job injury. I report the coefficient on the Monday variable for each injury type regression.

$$InjuryType_{it} = \alpha + \gamma Monday_{it} + \beta X_{it} + \alpha_t + \epsilon_{it} \tag{8.9}$$

Injury_Type is a binary variable for the type of injury, *Monday* is a binary variable that equals one if the injury occurred on a Monday or the Tuesday after a Monday public holiday and zero otherwise, and *X* is a matrix of variables associated with the claim.

8.5 Results

8.5.1 *t*-tests for excess injuries on a Monday

If lost-time injuries were evenly distributed across the working week (Monday to Friday) I would see 20 percent of injuries on each day of the week. The one-sided *t*-tests in Table 8.3 indicate that the proportion of lost-time injuries on a Monday, in New

Zealand, is statistically significantly higher than 20 percent. This is similarly the case for back injuries and sprains and strains.

Although the Monday Effect is not zero in New Zealand (as suggested in proposition one), it is statistically significantly smaller than that found in other jurisdictions, with 21.0% of injuries occurring on a Monday in New Zealand, 23.0% in Minnesota (Card & McCall, 1996) and 24.7% in Ontario (Campolieti & Hyatt, 2006) (see Table 8.4).

When I compare work injuries to off-the-job injuries in Table 8.5 I find that 20.5% of off-the-job injuries occur on a Monday. While this is statistically significantly higher than 20% it is a small effect. Like work injury, there are also statistically significantly more sprains and strains and back injuries on a Monday for off-the-job injury. Table 8.6 displays excess Monday claims tests for when the sample is extended to include all claims. The results are broadly consistent with that for the subsample of lost-time injury. Looking at overall claims for people who are not working (non-earners), there are no excess claims on a Monday (19.9 percent).

I also conduct t-tests to see whether the Monday Effect is unique to Mondays. Table 8.7 displays the results for work lost-time injuries and Table 8.8 displays the results for off-the-job lost-time injuries. Weeks with a public holiday are excluded from these two tables to improve comparability of the weekdays. The proportion of work injuries on a Monday, Tuesday and Wednesday are all statistically significantly different from 20 percent. This implies that injuries are elevated early in the week rather than just on a Monday. Table 8.8 shows that there are no excess off-the-job claims overall, but sprains and strains are elevated slightly on a Monday and Wednesday.

8.5.2 Regression results – Number of injuries

Table 8.9 displays the results of the linear regressions for on-the-job lost-time injury. Each row represents a separate regression with a dummy variable for the type of injury as the dependent variable. Robust-cluster standard errors are displayed. Model 1 contains only a Monday dummy variable; model 2 adds controls for number of compensation days, weekly gross benefits, age and gender; model 3 adds industry dummies; model 4 adds occupation dummies; model 5 adds year fixed effects; and model 6 adds ethnicity dummies. The number of observations is reported at the bottom of the table - the total number of observations refers to the injury diagnosis regressions while the total number of body part observations refers to the back injury regressions (information on body part injured is available only from 2015 onwards).

The results are consistent with previous studies (Campolieti & Hyatt, 2006; Card & McCall, 1996). Sprains and strains and back injuries make up a greater proportion of injuries on a Monday than on other weekdays after controlling for other characteristics. The magnitude of the estimate for back injuries is the same as that found by Campolieti and Hyatt (2006) with an excess of 2.7 percentage points. The magnitude of the estimate for sprains and strains is smaller at 1.6 percentage points compared to 2.6 percentage points in the Ontario study.

Table 8.10 displays the regression results for off-the-job injuries. Most of the Monday coefficients are in the same direction as on-the-job injuries and are slightly larger. Back injuries are 3.2 percentage points higher on a Monday than other weekdays and strains and sprains are 2.2 percentage points higher. This indicates that there may be something about Mondays that increases the risk of sprains and strains and back injuries more generally (proposition 3 and 5) rather than being caused by something specific to work (proposition 4).

8.5.3 Regression results – Duration of time off work

I look at the duration of time off work to see whether Monday claims differ from claims on other days. I run a linear regression with the log of the number of days of loss of earnings compensation paid (CompDays) and report the results of the Monday coefficient.

$$\log(CompDays) = \alpha + \gamma Monday + \beta X + \varepsilon \tag{8.10}$$

Table 8.11 displays the results for work injury. All of the coefficients on the Monday variable are negative, implying that Monday lost-time injuries involve fewer days away from work on average, compared to injuries on other days of the week. The overall duration of time off work for Monday injuries was 3.8 percentage points shorter than other weekdays. The duration was 6.5 percentage points shorter for sprains and strains on a Monday. The coefficient for back injuries was not statistically significantly different from zero because of the small sample size, though the magnitude of the estimate was similar to strains and sprains.

Table 8.12 displays the duration results for off-the-job injuries. The results are similar to work injuries with negative coefficients on the Monday variable in all the regressions. The duration of injuries overall are 5.8 percentage points shorter if they happened on a Monday, while the duration of sprains and strains are 8.3 percentage points shorter. The coefficient for back injuries is statistically significant for the off-the-job injuries; the duration of Monday back injuries is 10.4 percentage points shorter.

Table 8.13 contains robustness checks. It shows the Monday Effect persists when weekends and weeks with a public holiday are excluded from the sample (column 1) and when all claims are considered, including weekends and public holidays (column 3). Column 2 contains the results from the main tables for comparison. See Table E.1 in the Appendix for the full regression results when weekends are added to the sample.

8.6 Discussion

I make a unique contribution to the literature by looking at whether the Monday Effect in workers’ compensation persists within a broader accident compensation scheme and whether off-the-job injuries also exhibit a Monday Effect. I find that not only is the Monday Effect present in the work claims data; it is also present for off-the-job injuries. Both sets of injuries exhibit a higher proportion of strains and sprains and back injuries, consistent with the workers’ compensation literature (Campolieti & Hyatt, 2006; Card & McCall, 1996). I also find that Monday injuries involve fewer average days off work.

Unlike the US and Canada, New Zealand is less likely to be susceptible to people claiming an off-the-job injury from the weekend as happening at work on the Monday. This means the Monday Effect found here is unlikely to be a result of workers fraudulently claiming weekend injuries as occurring on the Monday at work. The magnitude of the results for New Zealand are smaller than that found elsewhere (Campolieti & Hyatt, 2006; Card & McCall, 1996), lending support to the conclusion of Martin-Roman and Moral (2016) that in countries with an incentive to claim weekend injuries as Monday work injuries, fraudulent claims are part of the explanation but not the full story.

One concern about the analysis approach might be that while injuries of one and two days duration are counted if they occur early in the week, if they happen on a Friday the person has the weekend to recover and therefore Friday claims are less likely to become lost-time injury claims than Monday claims (Wigglesworth, 2006). This is not a problem in the analysis here because I include only injuries that involve more than a week off work.

The finding that there is a Monday Effect for off-the-job strains and sprains and back injuries indicates that the reason is unlikely to be due to work-specific hazards such as less supervision or more difficult tasks. Instead it is most consistent with the hypothesis that job dissatisfaction prompts people to claim an injury to avoid work. This is the same conclusion that Richard J Butler et al. (2014) arrived at after finding that sick leave and health insurance claims were also more likely to occur on a Monday. This would also be consistent with the observation of a lower number of claims on a Friday, as research finds that people interviewed on a Friday tend to report higher job satisfaction than people interviewed in the middle of the week (Taylor, 2006)(Taylor, 2006)(Taylor, 2006)

Another explanation is that people who experience strains and sprains during the week wait to see if resting over the weekend will fix the problem. If it does not, then they see the doctor on the Monday and the date of the accident is recorded as the day of treatment; however, this seems unlikely because to be eligible for accident compensation requires a reasonably detailed description about how the injury occurred and when it occurred, particularly for injuries involving more than a week off work as used in this thesis. Although they may not receive treatment on the same day as the injury I think it is likely that the accident date will be correct.

The main limitation of this thesis is that I do not have data on the hours that people work by the day of the week. It is possible (but unlikely) that workers exposed to sprain and strain hazards, such as office workers and manual labourers, work more hours on Mondays resulting in higher numbers of injuries (although this would not explain the higher number of off-the-job injuries observed on Mondays). It is also possible that people are more likely to undertake activities such as heavy lifting at the start of the week, leading to higher prevalence of these types of injuries. Time use survey data may be a promising avenue for future research.

I find that there are an excess number of injuries, not just on a Monday, but also on a Tuesday and Wednesday. Although the literature focuses on excess Monday injuries, other studies also exhibit a lower proportion of injuries on a Friday (Campolieti & Hyatt, 2006; Card & McCall, 1996; Mason, 1979; Wigglesworth, 2006). Perhaps the focus of this literature needs to shift. Is the Monday effect really a Friday effect?

8.7 Tables and Figures

Table 8.1: The read codes used to assign claims to injury type categories

Injury type	**ACC Read code**
Strains and Sprains	S5
Cuts and lacerations;	S8, S9 & SA
Contusions;	SE
Fractures;	S0, S1, S2 & S3
Burns;	SH
Dislocations	S4 (excluding S4A)
Other	All other including S4A

Figure 8.1: Distribution of lost-time injuries by weekday for workers

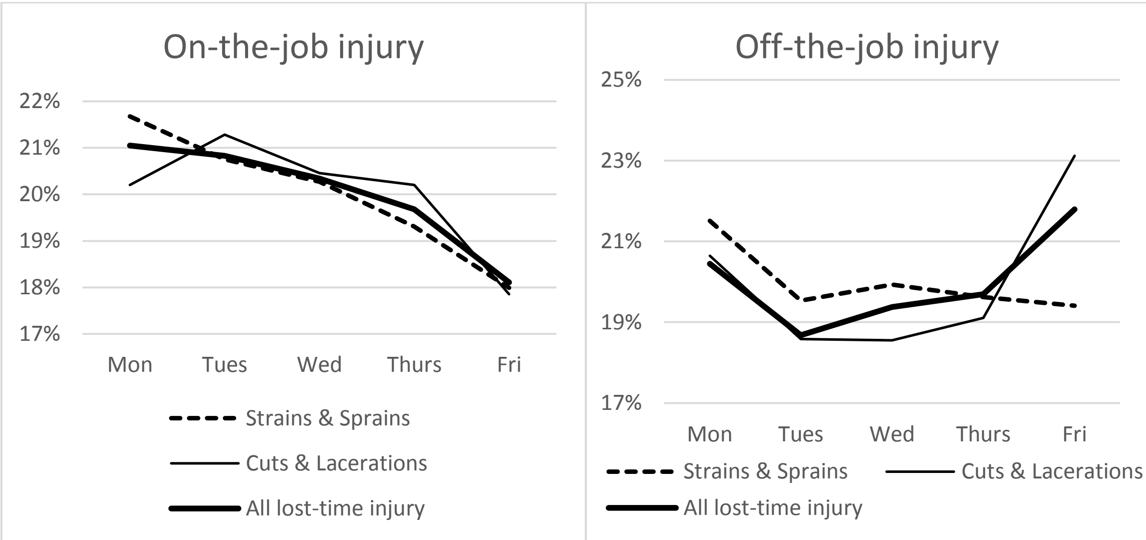


Figure 8.2: Distribution of lost-time injuries by day of the week for workers

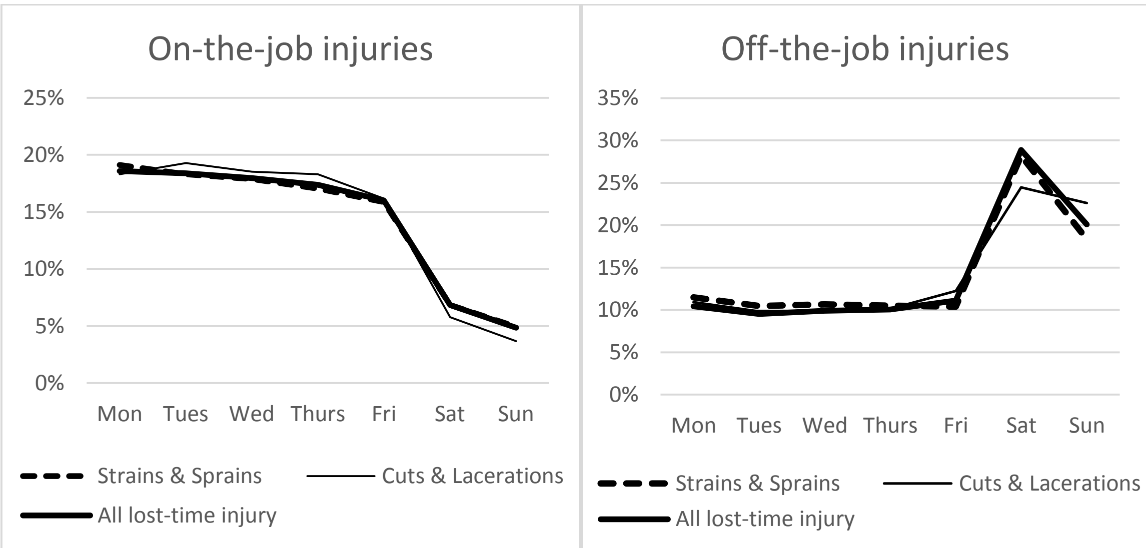


Figure 8.3: Distribution of all injury claims (includes treatment only claims) by weekday for workers

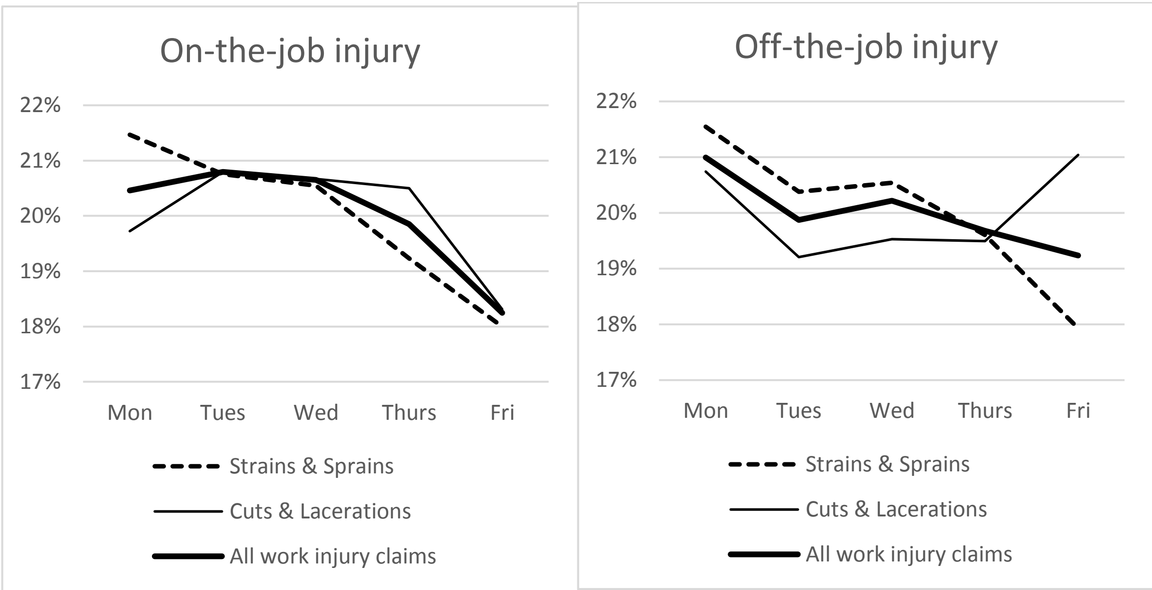


Figure 8.4: Distribution of all injury claims (includes treatment only claims) by day of the week for workers

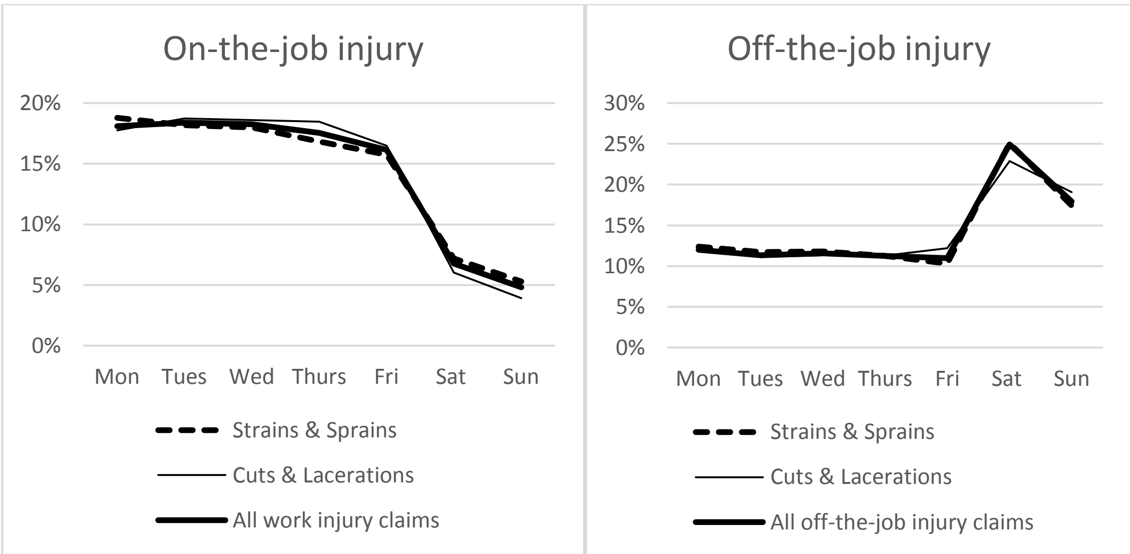


Table 8.2: Mean lost-time worker claim characteristics by weekday and whether the injury occurred at work

	Work injury claims*			***Off-the-job injury claims****		
	Full Weekday Sample	***Monday Claims***	***Other Weekday Claims***	***Full Weekday Sample***	***Monday Claims***	***Other Weekday Claims***
Day of the Week						
Monday	0.210			0.205		
	(0.407)			(0.403)		
Tuesday	0.208			0.187		
	(0.406)			(0.390)		
Wednesday	0.203			0.194		
	(0.402)			(0.395)		
Thursday	0.197			0.197		
	(0.398)			(0.398)		
Friday	0.181			0.218		
	(0.385)			(0.413)		
Part of the body affected						
Back	0.301	0.332	0.293	0.139	0.164	0.132
	(0.459)	(0.471)	(0.455)	(0.346)	(0.370)	(0.339)
Weekly compensation days paid	99.500	98.764	99.697	83.105	81.416	83.539
	(259.032)	(260.659)	(258.596)	(212.479)	(212.794)	(212.396)
Nature of Injury						
Strains & Sprains	0.376	0.387	0.373	0.357	0.375	0.352
	(0.484)	(0.487)	(0.484)	(0.479)	(0.484)	(0.478)
Contusions	0.057	0.055	0.058	0.054	0.056	0.054
	(0.232)	(0.228)	(0.234)	(0.227)	(0.229)	(0.226)
Cuts & Lacerations	0.107	0.103	0.108	0.067	0.067	0.067
	(0.309)	(0.304)	(0.310)	(0.250)	(0.251)	(0.249)
Fractures	0.116	0.113	0.117	0.249	0.233	0.253
	(0.320)	(0.317)	(0.321)	(0.432)	(0.423)	(0.435)
Burns	0.010	0.009	0.011	0.010	0.009	0.010
	(0.099)	(0.094)	(0.104)	(0.098)	(0.096)	(0.099)
Dislocations	0.036	0.034	0.036	0.066	0.061	0.067
	(0.186)	(0.181)	(0.186)	(0.248)	(0.239)	(0.2507)
Other	0.297	0.298	0.297	0.198	0.199	0.198
	(0.457)	(0.457)	(0.457)	(0.399)	(0.399)	(0.398)
Weekly Gross Benefits	$359.28	$365.30	$357.68	$400.93	$409.15	$398.82
	($230.01)	($228.61)	($230.35)	($236.54)	($237.88)	($236.14)
Demographic characteristics						
Age	41.175	41.053	41.208	39.391	39.847	39.274
	(13.481)	(13.437)	(13.493)	(14.439)	(14.281)	(14.477)
Male	0.759	0.767	0.757	0.611	0.603	0.613
	(0.428)	(0.423)	(0.429)	(0.487)	(0.489)	(0.487)
Number of Observations	***335,493***	***70,611***	***264,882***	***272,658***	***55,761***	***216,897***

Note: Standard deviations in parentheses

Table 8.3: Fraction of Monday injuries across different jurisdictions along with tests of excess

	New Zealand data Used in this paper			*Ontario Data Used in Campoleti & Hyatt*			*Minnesota Data Used in Card & McCall*		
Type of injury	**N**	**Mean**	**Test Statistic**	**N**	**Mean**	**Test Statistic**	**N**	**Mean**	**Test Statistic**
All	335,493	0.210	14.874	10,702	0.247	11.297	21,314	0.230	10.77
Back	5,793	0.214	2.695	3,564	0.262	8.391	-	-	-
Sprains & Strains	126,108	0.217	14.469	5,282	0.258	9.633	9,560	0.237	9.12
Cuts & Lacerations	35,967	0.202	0.943	1,008	0.219	1.473	2,375	0.212	1.44
Dislocations	12,015	0.201	0.419	49	0.286	1.314	602	0.248	2.91
Burns	3,504	0.176	-3.661	174	0.195	-0.153	443	0.192	0.43
Contusions	19,146	0.204	1.342	1,411	0.240	3.475	1,453	0.233	3.17
Fractures	39,063	0.205	2.200	623	0.238	2.204	1,274	0.199	0.12

Note: One-sided t-tests for whether the proportion of injuries on a Monday is statistically significantly different to 20%.

Table 8.4: Comparison of the Monday Effect for work injury across different jurisdictions

Jurisdiction	Proportion of work claims on a Monday	Standard Error	95% confidence interval	
Minnesota	0.230	0.003	0.227	0.233
Ontario	0.247	0.004	0.243	0.251
New Zealand	0.210	0.001	0.209	0.211

Note: Claims restricted to weekdays. The estimates for Minnesota come from Card and McCall (1996) and those for Ontario come from Campolieti and Hyatt (2006)

Table 8.5: Fraction of Monday lost-time injuries across different injury categories with tests of excess

Type of injury	*Work Injuries* (workers)* N	Mean	Test Statistic	*Off-The-Job Injuries* (workers)* N	Mean	Test Statistic
All	335,493	0.210	14.874	272,658	0.205	5.845
Back	5,793	0.214	2.695	4,224	0.252	7.754
Sprains & Strains	126,108	0.217	14.469	97,254	0.215	11.446
Cuts & Lacerations	35,967	0.202	0.943	18,195	0.206	2.132
Dislocations	12,015	0.201	0.419	17,898	0.190	-3.360
Burns	3,504	0.176	-3.661	2,649	0.197	-0.440
Contusions	19,146	0.204	1.342	14,817	0.209	2.687
Fractures	39,063	0.205	2.200	67,818	0.191	-5.621

** Excludes motor vehicle injuries (these are funded from a different account)*
Note: Excludes weekend injuries

Table 8.6: Fraction of Monday injury claims (all claims including treatment only claims) across different injury categories with tests of excess

Type of injury	*Work Injuries* (workers)* N	Mean	Test Statistic	*Off-the-job Injuries* (workers)* N	Mean	Test Statistic	*Non-Earners' Injuries** N	Mean	Test Statistic
All	3,132,795	0.205	20.058	4,983,969	0.210	54.475	8,612,664	0.199	-9.7
Back	52,320	0.218	10.213	112,380	0.229	23.212	98,010	0.210	7.5
Sprains & Strains	1,299,501	0.215	40.705	2,798,574	0.215	62.958	2,922,219	0.202	7.2
Cuts & Lacerations	498,801	0.197	-4.898	505,338	0.207	12.956	1,647,747	0.202	5.7
Dislocations	41,673	0.198	-0.887	99,006	0.197	-2.502	119,220	0.189	-10.1
Burns	54,543	0.180	-12.022	57,246	0.204	2.476	146,820	0.206	5.6
Contusions	286,842	0.199	-1.114	476,757	0.199	-2.462	1,351,521	0.195	-14.9
Fractures	91,200	0.200	-0.351	227,805	0.192	-9.232	654,300	0.187	-26.0

** Excludes motor vehicle injuries (these are funded from a different account)*
Note: Excludes weekend injuries

Table 8.7: Work lost-time injuries: Fraction across different days of the week and injury categories with tests of excess

Type of injury	***All claims*** *N=270,447*		***Sprains*** *N=101,589*		***Fractures*** *N=31,635*		***Contusions*** *N=15,525*	
	Mean	**Test Statistic**	**Mean**	**Test Statistic**	**Mean**	**Test Statistic**	**Mean**	**Test Statistic**
Monday	0.217	21.54	0.224	18.17	0.210	4.30	0.210	3.02
Tuesday	0.205	6.67	0.204	3.09	0.205	2.13	0.211	3.44
Wednesday	0.201	1.92	0.200	0.34	0.204	1.70	0.208	2.44
Thursday	0.194	-7.40	0.191	-7.24	0.195	-2.43	0.196	-1.35
Friday	0.182	-24.40	0.181	-15.88	0.187	-5.99	0.175	-8.12

** Excludes motor vehicle injuries (these are funded from a different account)*
Note: Standard working weeks - excludes weekend injuries, the two-week Christmas and New Year's Day period and weeks with a public holiday.

Table 8.8: Off-the-job lost-time injuries: Fraction across different days of the week and injury categories with tests of excess

Type of injury	***All claims*** *N= 214,104*		***Sprains*** *N= 76,329*		***Fractures*** *N= 53,481*		***Contusions*** *N= 11,655*	
	Mean	**Test Statistic**	**Mean**	**Test Statistic**	**Mean**	**Test Statistic**	**Mean**	**Test Statistic**
Monday	0.198	-1.84	0.209	6.11	0.184	-9.48	0.204	1.13
Tuesday	0.188	-14.00	0.196	-2.98	0.179	-12.66	0.185	-4.10
Wednesday	0.197	-3.70	0.203	2.04	0.191	-5.47	0.198	-0.58
Thursday	0.198	-1.84	0.197	-2.30	0.200	-0.29	0.193	-2.02
Friday	0.218	20.36	0.196	-3.04	0.247	25.03	0.220	5.21

** Excludes motor vehicle injuries (these are funded from a different account)*
Note: Standard working weeks - excludes weekend injuries, the two-week Christmas and New Year's Day period and weeks with a public holiday.

Table 8.9: Lost-Time Work Injuries OLS Estimates of the "Monday Effect" from Linear Probability Models by Type of Injuries

Type of Injury	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model5	(6) Model 6
Sprains & Strains	0.0152***	0.0158***	0.0159***	0.0158***	0.0157***	0.0156***
	(0.00201)	(0.00200)	(0.00200)	(0.00200)	(0.00199)	(0.00200)
Cuts and Lacerations	-0.00572***	-0.00653***	-0.00679***	-0.00691***	-0.00710***	-0.00723***
	(0.00126)	(0.00125)	(0.00124)	(0.00124)	(0.00124)	(0.00125)
Contusions	-0.00225**	-0.00208**	-0.00211**	-0.00217**	-0.00219**	-0.00234**
	(0.000949)	(0.000948)	(0.000948)	(0.000948)	(0.000948)	(0.000953)
Fractures	-0.00405***	-0.00463***	-0.00437***	-0.00422***	-0.00437***	-0.00422***
	(0.00131)	(0.00131)	(0.00131)	(0.00131)	(0.00131)	(0.00132)
Dislocations	-0.00182**	-0.00207***	-0.00193**	-0.00187**	-0.00197***	-0.00188**
	(0.000757)	(0.000757)	(0.000756)	(0.000756)	(0.000756)	(0.000762)
Burns	-0.00237***	-0.00239***	-0.00222***	-0.00220***	-0.00222***	-0.00220***
	(0.000393)	(0.000393)	(0.000392)	(0.000392)	(0.000392)	(0.000396)
Back Injury	0.0272***	0.0277***	0.0271***	0.0269***	0.0269***	0.0266***
	(0.00650)	(0.00650)	(0.00646)	(0.00646)	(0.00646)	(0.00646)
Control for observable characteristics		Yes	Yes	Yes	Yes	Yes
Industry Dummies			Yes	Yes	Yes	Yes
Occupation Dummies				Yes	Yes	Yes
Year Dummies					Yes	Yes
Ethnicity						Yes
Number of Observations	335,493	335,451	335,451	335,451	335,451	332,343
Number of Observations (body part)	25,062	25,062	25,062	25,062	25,062	25,059

Notes: The dependent variable in each regression is a dummy variable for the type of injury. The table reports coefficient estimates for the Monday/first Tuesday back from a public holiday dummy variable from several different linear probability regressions that estimate the incidence of each type of injury. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and gross weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO.

*** p<0.01, ** p<0.05, * p<0.1

Table 8.10: Off-the-Job Lost-Time Injuries to Workers OLS Estimates of the “Monday Effect” from Linear Probability Models by Type of Injury

Type of Injury	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
Sprains & Strains	0.0248***	0.0228***	0.0224***	0.0223***	0.0223***	0.0223***
	(0.00224)	(0.00223)	(0.00223)	(0.00223)	(0.00223)	(0.00223)
Cuts and Lacerations	0.000182	0.000733	0.000794	0.000647	0.000575	0.000321
	(0.00116)	(0.00115)	(0.00115)	(0.00115)	(0.00115)	(0.00115)
Contusions	0.00137	0.00121	0.00116	0.00105	0.000948	0.000875
	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)
Fractures	-0.0204***	-0.0190***	-0.0187***	-0.0186***	-0.0185***	-0.0184***
	(0.00197)	(0.00196)	(0.00196)	(0.00196)	(0.00196)	(0.00196)
Dislocations	-0.00569***	-0.00518***	-0.00497***	-0.00491***	-0.00490***	-0.00487***
	(0.00112)	(0.00112)	(0.00112)	(0.00112)	(0.00112)	(0.00112)
Burns	-0.000585	-0.000462	-0.000447	-0.000470	-0.000487	-0.000533
	(0.000446)	(0.000446)	(0.000447)	(0.000447)	(0.000447)	(0.000446)
Back injuries	0.0330***	0.0319***	0.0316***	0.0316***	0.0316***	0.0319***
	(0.00488)	(0.00488)	(0.00487)	(0.00487)	(0.00487)	(0.00488)
Control for observable characteristics		Yes	Yes	Yes	Yes	Yes
Industry Dummies			Yes	Yes	Yes	Yes
Occupation Dummies				Yes	Yes	Yes
Year Dummies					Yes	Yes
Ethnicity						Yes
Number of Observations	272,658	272,643	272,643	272,643	272,643	272,562
Number of Observations (body part)	30,351	30,351	30,351	30,351	30,351	30,348

Notes: The dependent variable in each regression is a dummy variable for the type of injury. The table reports coefficient estimates for the Monday/ first Tuesday back from a public holiday dummy variable from several different linear probability regressions that estimate the incidence of each type of injury. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO.

*** p<0.01, ** p<0.05, * p<0.1

Table 8.11: Log Duration of On-the-Job Injuries OLS Estimates of the "Monday Effect" by Type of Injury

Type of Injury	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
All injuries	-0.0407***	-0.0378***	-0.0386***	-0.0385***	-0.0379***	-0.0375***
Standard Error	(0.00547)	(0.00541)	(0.00537)	(0.00537)	(0.00537)	(0.00540)
Number of observations	335,493	335451	335451	335451	335451	332343
Sprains & Strains	-0.0693***	-0.0667***	-0.0670***	-0.0665***	-0.0652***	-0.0645***
Standard Error	(0.00901)	(0.00891)	(0.00886)	(0.00886)	(0.00883)	(0.00885)
Number of observations	126,108	126,090	126,090	126,090	126,090	125,556
Cuts and Lacerations	-0.0568***	-0.0445***	-0.0461***	-0.0455***	-0.0445***	-0.0429***
Standard Error	(0.0150)	(0.0148)	(0.0146)	(0.0146)	(0.0146)	(0.0146)
Number of observations	35,973	35,967	35,967	35,967	35,967	35,865
Contusions	-0.0531**	-0.0372*	-0.0352	-0.0342	-0.0342	-0.0332
Standard Error	(0.0223)	(0.0219)	(0.0218)	(0.0218)	(0.0217)	(0.0219)
Number of observations	19,146	19,146	19,146	19,146	19,146	19,035
Fractures	-0.0517***	-0.0480***	-0.0523***	-0.0525***	-0.0519***	-0.0521***
Standard Error	(0.0144)	(0.0142)	(0.0141)	(0.0141)	(0.0140)	(0.0140)
Number of observations	39,063	39,063	39,063	39,063	39,063	38,994
Dislocations	-0.0155	-0.0179	-0.0154	-0.0198	-0.0208	-0.0238
Standard Error	(0.0269)	(0.0268)	(0.0267)	(0.0267)	(0.0267)	(0.0268)
Number of observations	12,012	12,012	12,012	12,012	12,012	11,985
Burns	-0.0437	-0.0129	-0.000393	0.00155	0.00160	-0.00107
Standard Error	(0.0484)	(0.0467)	(0.0458)	(0.0458)	(0.0460)	(0.0463)
Number of observations	3,504	3,504	3,504	3,504	3,504	3,492
Back injuries	-0.0712*	-0.0706*	-0.0663	-0.0583	-0.0556	-0.0500
Standard Error	(0.0415)	(0.0414)	(0.0410)	(0.0410)	(0.0408)	(0.0408)
Number of observations	5,796	5,796	5,796	5,796	5,796	5,790
Control for observable characteristics		Yes	Yes	Yes	Yes	Yes
Industry Dummies			Yes	Yes	Yes	Yes
Occupation Dummies				Yes	Yes	Yes
Year Dummies					Yes	Yes
Ethnicity						Yes

Notes: The dependent variable in each regression is the log of the total number of compensated days for each type of injury. The table reports coefficient estimates for the Monday/ first Tuesday back from a public holiday dummy variable from several different log duration regressions. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO.

*** p<0.01, ** p<0.05, * p<0.1

Table 8.12: Log Duration of Off-the-Job injuries OLS Estimates of the "Monday Effect" by Type of Injury *(t-statistics in parentheses).*

	(1)	(2)	(3)	(4)	(5)	(6)
Type of Injury	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
All injuries	-0.0551***	-0.0594***	-0.0598***	-0.0600***	-0.0591***	-0.0580***
Standard Error	(0.00592)	(0.00586)	(0.00586)	(0.00584)	(0.00584)	(0.00583)
Number of observations	272,658	272,643	272,643	272,643	272,643	272,562
Sprains & Strains	-0.0794***	-0.0823***	-0.0823***	-0.0838***	-0.0842***	-0.0828***
Standard Error	(0.00995)	(0.00985)	(0.00984)	(0.00981)	(0.00977)	(0.00976)
Number of observations	97,257	97,257	97,257	97,257	97,257	97,227
Cuts and Lacerations	-0.0631***	-0.0600***	-0.0615***	-0.0623***	-0.0613***	-0.0628***
Standard Error	(0.0213)	(0.0211)	(0.0211)	(0.0211)	(0.0211)	(0.0211)
Number of observations	18,198	18,198	18,198	18,198	18,198	18,192
Contusions	-0.0208	-0.0242	-0.0261	-0.0257	-0.0217	-0.0193
Standard Error	(0.0251)	(0.0249)	(0.0249)	(0.0248)	(0.0248)	(0.0248)
Number of observations	14,820	14,820	14,820	14,820	14,820	14,814
Fractures	-0.0178*	-0.0263***	-0.0282***	-0.0270***	-0.0258**	-0.0256**
Standard Error	(0.0103)	(0.0101)	(0.0101)	(0.0101)	(0.0100)	(0.0100)
Number of observations	67,815	67,812	67,812	67,812	67,812	67,785
Dislocations	-0.0341	-0.0312	-0.0303	-0.0251	-0.0244	-0.0230
Standard Error	(0.0222)	(0.0220)	(0.0220)	(0.0218)	(0.0218)	(0.0219)
Number of observations	17,904	17,904	17,904	17,904	17,904	17,892
Burns	-0.0302	-0.0129	-0.00382	0.00386	-0.00121	0.00679
Standard Error	(0.0525)	(0.0518)	(0.0521)	(0.0518)	(0.0517)	(0.0520)
Number of observations	2,643	2,643	2,643	2,643	2,643	2,643
Back injuries	-0.114***	-0.110**	-0.117***	-0.115***	-0.110**	-0.104**
Standard Error	(0.0439)	(0.0439)	(0.0437)	(0.0438)	(0.0437)	(0.0437)
Number of observations	4,227	4,227	4,227	4,227	4,227	4,227
Control for observable characteristics		Yes	Yes	Yes	Yes	Yes
Industry Dummies			Yes	Yes	Yes	Yes
Occupation Dummies				Yes	Yes	Yes
Year Dummies					Yes	Yes
Ethnicity						Yes

Notes: The dependent variable in each regression is the log of the total number of days of compensation paid for each type of injury. The table reports coefficient estimates for the Monday/first Tuesday back from a public holiday dummy variable from several different log duration regressions. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8.13: Robustness check of lost-time injuries OLS estimates of the "Monday Effect" from linear probability models by type of injuries

Type of Injury	(1)	(2)	(3)
Work Sprains & Strains	0.0154***	0.0156***	0.0188***
	(0.00226)	(0.00200)	(0.00261)
Off-the-Job Sprains & Strains	0.0218***	0.0223***	0.0170***
	(0.00261)	(0.00223)	(0.00290)
Work Contusions	-0.00247**	-0.00234**	-0.00259**
	(0.00108)	(0.000953)	(0.00126)
Off-the-Job Contusions	0.00157	0.000875	0.00217
	(0.00124)	(0.00106)	(0.00137)
Work Fractures	-0.00521***	-0.00422***	-0.00467***
	(0.00149)	(0.00132)	(0.00173)
Off-the-Job Fractures	-0.0210***	-0.0184***	-0.0137***
	(0.00229)	(0.00196)	(0.00257)
Sample restrictions			
Includes weeks with public holidays		Yes	Yes
Includes public holidays		Yes	Yes
Includes weekends			Yes
Independent variables			
Includes dummy variables for other days of the week			Yes
Number of Observations			
Work claims	267,936	332,346	376,242
Off-the-Job claims	214,035	272,562	534,381

Notes: Each model has a different sample restriction applied. Column 1 excludes weekends and weeks with a public holiday, column 2 excludes weekends (the approach used in the main results), and column 3 includes all claims including weekends and public holidays. It shows the Monday Effect is robust to these different specifications. The dependent variable in each regression is a dummy variable for the type of injury. The table reports coefficient estimates for the Monday/ first Tuesday back from a public holiday dummy variable from several different linear probability regressions that estimate the incidence of each type of injury. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO. Models 1-3 include a dummy variable for whether the injury occurred on a Monday or not. Model 4 includes dummy variables for each day of the week with Thursday as the reference.

*** p<0.01, ** p<0.05, * p<0.1

Chapter 9

Conclusions

With its universal claim environment and availability of linked unit record data, New Zealand is an ideal setting for quantitative injury research. In this thesis I have exploited these advantages to test three elements of misreporting within claims data: the gap between self-reported injury and accepted claims; claims shifting following the introduction of experience rating (underreporting of work injury); and overreporting of work injury on a Monday.

9.1 Variation in access to healthcare services is an important factor in propensity to claim

Claims data are a convenient but imperfect source of information for injury surveillance. As reviewed in section 3.5, misreporting of injury within claims data can arise from different perceptions about eligibility for compensation, the seriousness of the injury, ease of claiming, concern over how others might react, financial incentives and access to health services. If the claims data are used without consideration of the variation in propensity to claim it could lead to incorrect conclusions about the need for investment in injury prevention, inequitable distribution of injury prevention resources, and inaccurate assessments regarding the effectiveness of injury prevention programmes.

The universal claims environment presents fewer barriers to making an injury claim compared to workers' compensation (for example there is no requirement for proof that an injury is work-related). Despite this, I find that about a third of people with a limiting injury do not receive injury compensation (chapter 6); similar in magnitude to that found in other countries. This did not vary by whether the person was a worker or whether the injury occurred at work. This indicates that access to healthcare services may be a larger driver of underreporting than barriers such as proof that an injury is work-related. Access to healthcare services varies by income, ethnicity and regional area, introducing bias into the claims data. These findings highlight the limitations of relying on healthcare utilisation data for injury surveillance and the importance of supplementing it with other sources of injury information (such as survey data) to address the consequent bias. Future research could look at opportunities to reduce barriers to claiming, particularly for more vulnerable populations.

The limiting injury survey question used here differs from the lost-time injury question more commonly used in other countries (e.g., Safe Work Australia (2011)). This means that non-earners were able to be included in this research, but it also means the results are not directly comparable to studies that use a lost-time injury question. The New Zealand General Social Survey has recently been added to the IDI and it includes self-reported information on any kind of physical health problem or injury while working in the last 12 months and asks whether it caused any additional costs, loss of money or income. Information from this survey could be used in future to check that these results are robust to the wording of the injury question.

While the Integrated Data Infrastructure presents a powerful tool for injury research, some populations are not well captured within the data, such as temporary visitors to New Zealand and illegal workers. These individuals are likely to be less aware of their entitlements and less able to access them, placing downward bias on the estimates of misreporting produced here.

9.2 Claiming incentives are well-aligned in a universal claims environment

The quantitative evidence presented here suggests that claiming incentives are well-aligned within the New Zealand's claims system, with no evidence found for claims shifting following the introduction of experience rating (chapter 7); and a much smaller Monday effect than that found elsewhere (Campolieti & Hyatt, 2006; Card & McCall, 1996) (chapter 8). These results imply that accident claims data are not seriously biased from misreporting of injury between the work and earners accounts and can be used in research and evaluation with greater confidence. Maintenance of checks and balances to identify and investigate potential cases of claims shifting remains important.

Although this research found that the introduction of experience rating was not associated with claims shifting, it presents only weak evidence that the intervention was associated with a decrease in work claims. The data indicate that the firms targeted by the programme were already reducing their work injury numbers in the years prior to the policy introduction. It seems likely that there are other more important drivers of injury prevention for firms than that represented by experience rating.

Claims data provide a powerful source of information about the injury environment. These findings indicate that a universal claims environment generally promotes lodgement of injury claims and discourages misreporting to a greater extent than that found under workers’ compensation.

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Appendix A

A Glossary

Accredited Employer Programme: This is a voluntary ACC programme in which participating employers are responsible for managing their own claims in return for an insurance levy reduction. They may choose to do this in-house or through a third-party provider. See Accident Compensation Corporation (2017c) for more information.

Entitlement claim: An entitlement claim is a claim that involves more than just compensation for treatment costs. Additional entitlements include things such as weekly compensation, compensation for rehabilitation costs, and lump sum payments (Statistics New Zealand, 2015).

Limiting injury: If a person reports in the Survey of Family, Income and Employment that they have had an injury in the last 12 months that stopped them from doing their usual activity for more than a week it is referred to here as a limiting injury.

Usual activities: The term 'usual activities' is used in the limiting injury question in the Survey of Family, Income and Employment but the term is not defined. I assume that it would be interpreted to include paid and unpaid work and recreational activities.

Weekly compensation claim: This is a claim in which workers receive compensation loss of earnings when they are unable to work because of their injury. In New Zealand, there is a one-week stand-down period for weekly compensation. Therefore, it captures injuries that involve more than a week off work.

Appendix B

B Appendices for Chapter 5

B.1 Appendix figures and tables

Figure B.1: ACC45 form

ACC 45 **ACC Injury Claim Form**

Patient to complete

PART A: PERSONAL DETAILS

Family name SURNAME

First name(s)

Date of birth DAY MONTH YEAR ○ Male ○ Female

Home/postal address NUMBER STREET NAME

SUBURB TOWN/CITY

Telephone Work 0 CODE Home 0 CODE

What is your ethnic background? *This information is collected for statistical reasons only, to help ACC develop services that are culturally appropriate.*

○ NZ European/Pakeha ○ Cook Island Maori ○ Fijian ○ Indian ○ Samoan ○ Other ethnic group – *please specify*

○ Other European ○ Tongan ○ Other Pacific ○ Other Asian ○ Tokelauan

○ NZ Maori ○ Niuean ○ South East Asian ○ Chinese ○ I'd prefer not to say

Sample

PART B: ACCIDENT & EMPLOYMENT DETAILS *If required, you can provide further information in answer to the following questions on a separate sheet of paper*

When did the accident happen? DAY MONTH YEAR at TIME ○ am ○ pm

Accident scene *(e.g. home, place of work, road)*

Accident location *(e.g. Taupo)* Did the accident occur in New Zealand? ○ Yes ○ No

What were you doing – what happened – how was the injury caused? (e.g. cleaning kitchen, slipped on wet floor and hit head on table)

Did the accident involve a moving vehicle on a public road? ○ Yes ○ No If sporting injury, name sport *(e.g. rugby union)*

Occupation

Please tick those that apply: ○ I work part-time or full-time ○ I own /part own the company in which I work ○ I am self-employed ○ I am not employed

What type of work do you do? ○ Sedentary (brief standing and walking) ○ Light (mainly standing and walking) ○ Medium (often lift 9kg plus) ○ Heavy (often lift 9kg plus) ○ Very Heavy (often lift 23kg plus)

Did the accident happen at work? ○ Yes ○ No

What is the name of the business you are employed by/own?

What is the address of the business you are employed by/own?

PART C: PATIENT DECLARATION

I have read and understood the important Patient Information and Patient Declaration on the reverse of the patient copy of this form.

Patient to sign here or legal guardian or representative ✗ Date DAY MONTH YEAR

Authorised representative's name Authorised representative's relationship to patient

ACC uses this information to determine whether the claim can be accepted and to derive statistical data about the causes of injuries.

Occupation information helps ACC to estimate the impact of injuries on individuals in particular occupations.

The employer name & address is required for all work injuries (ACC must notify the employer) and all non-work injuries that involve time off work (ACC contacts the employer about earnings data & job protection).

The form must be signed and dated before it can be accepted by ACC (this includes an electronic signature).

The employee signature, in conjunction with the patient declaration on the reverse of the form, authorise the provider to lodge the claim with ACC and to release information to ACC and its agents.

Source: Getting help and what to know if you've been injured at work, September 2009. Accessed 20 May 2016.
http://union.org.nz/sites/union/files/AEP%20booklet%20final%20Sep%2009.pdf

Appendix C

C Appendices for Chapter 6

C.1 Appendix figures and tables

Table C.1: OLS comparison of alternative ways of treating the age variable

VARIABLES	OLS Full sample Age No age squared	OLS Full sample Age & Age squared	OLS Age <75 Age No age squared	OLS Age <75 Age & Age squared	OLS Full sample Age categories
Female	0.0020	0.00794	0.000275	0.00426	0.00738
	(0.0139)	(0.0139)	(0.0145)	(0.0145)	(0.0139)
Age (10 years)	-0.025***	-0.119***	-0.0333***	-0.108***	
	(0.00413)	(0.0193)	(0.00485)	(0.0264)	
Age squared		0.00999***		0.00868***	
		(0.00202)		(0.00305)	
Age 45-55 (reference)					
Age <25					0.157***
					(0.0235)
Age 25-35					0.0115
					(0.0241)
Age 35-45					0.0213
					(0.0203)
Age 55-65					-0.0151
					(0.0226)
Age 65-75					-0.0450
					(0.0281)
Age 75-85					-0.0117
					(0.0331)
Age 85-95					0.125***
					(0.0480)
Age 95+					-0.273
					(0.212)
Born in NZ	0.00324	0.00522	-0.00308	-0.000757	0.00631
	(0.0226)	(0.0226)	(0.0241)	(0.0240)	(0.0226)
NZ European (reference)					
Other European	0.0305	0.0276	0.0153	0.0139	0.0320
	(0.0339)	(0.0339)	(0.0376)	(0.0377)	(0.0339)
Māori	-0.119***	-0.109***	-0.113***	-0.108***	-0.111***
	(0.0281)	(0.0284)	(0.0283)	(0.0285)	(0.0284)
Samoan	-0.0627	-0.0610	-0.0647	-0.0644	-0.0628
	(0.0565)	(0.0568)	(0.0567)	(0.0570)	(0.0563)
Chinese	-0.289***	-0.279***	-0.289***	-0.282***	-0.273***
	(0.0694)	(0.0693)	(0.0736)	(0.0734)	(0.0696)
European & Māori	-0.0421	-0.0384	-0.0423	-0.0391	-0.0358
	(0.0297)	(0.0296)	(0.0299)	(0.0298)	(0.0295)
Other ethnicity/ies	-0.103***	-0.0998***	-0.101***	-0.0987***	-0.101***
	(0.0284)	(0.0283)	(0.0290)	(0.0290)	(0.0283)
Lives with a partner	-0.0263*	-0.00136	-0.0163	-0.00336	0.00164
	(0.0144)	(0.0154)	(0.0156)	(0.0163)	(0.0154)
Highest qualification: None (reference)					
School qualifications	0.0468**	0.0421**	0.0426**	0.0432**	0.0392**
	(0.0182)	(0.0181)	(0.0193)	(0.0193)	(0.0182)
Vocational	0.0370**	0.0472***	0.0383**	0.0468**	0.0459**
	(0.0177)	(0.0179)	(0.0188)	(0.0190)	(0.0179)
Degree	0.0248	0.0352	0.0227	0.0312	0.0361
	(0.0246)	(0.0247)	(0.0256)	(0.0258)	(0.0246)
Other post-school	0.0991**	0.102**	0.0900*	0.0946**	0.101**
	(0.0426)	(0.0426)	(0.0468)	(0.0470)	(0.0428)
Location: Main urban area (reference)					
Secondary urban area	-0.0425*	-0.0429*	-0.0529**	-0.0524**	-0.0406*
	(0.0239)	(0.0237)	(0.0253)	(0.0253)	(0.0238)
Minor urban area	-0.0256	-0.0257	-0.0287	-0.0294	-0.0226
	(0.0221)	(0.0220)	(0.0234)	(0.0233)	(0.0220)
Rural area	-0.0406*	-0.0377*	-0.0401*	-0.0393*	-0.0361*
	(0.0212)	(0.0213)	(0.0216)	(0.0216)	(0.0212)
Log annual household income	0.00917	0.00863	0.00780	0.00721	0.00749

	(0.00728)	(0.00726)	(0.00748)	(0.00746)	(0.00721)
Employed at HED	-0.0153	-0.00476	-0.0147	-0.00595	-0.0111
	(0.0247)	(0.0247)	(0.0249)	(0.0251)	(0.0249)
Occupation: Manager (reference)					
Professional	-0.0315	-0.0377	-0.0319	-0.0359	-0.0343
	(0.0298)	(0.0299)	(0.0300)	(0.0301)	(0.0299)
Associate Professional	-0.0201	-0.0278	-0.0210	-0.0259	-0.0241
	(0.0316)	(0.0316)	(0.0318)	(0.0319)	(0.0316)
Clerical Services	0.0338	0.0276	0.0312	0.0272	0.0311
	(0.0301)	(0.0301)	(0.0303)	(0.0303)	(0.0302)
Community & Personal Service	-0.0157	-0.0327	-0.0215	-0.0319	-0.0321
	(0.0281)	(0.0283)	(0.0283)	(0.0286)	(0.0284)
Agricultural & Fisheries	0.0679*	0.0591	0.0646*	0.0594	0.0625*
	(0.0365)	(0.0364)	(0.0368)	(0.0368)	(0.0367)
Craft and Trades Workers	0.0422	0.0340	0.0376	0.0330	0.0356
	(0.0333)	(0.0332)	(0.0334)	(0.0334)	(0.0333)
Machine Operators & Drivers	0.0794**	0.0758**	0.0750**	0.0740**	0.0759**
	(0.0323)	(0.0323)	(0.0326)	(0.0325)	(0.0323)
Labourers	0.00284	-0.0102	-0.00538	-0.0130	-0.0112
	(0.0340)	(0.0340)	(0.0343)	(0.0344)	(0.0339)
No occupation (did not work)	0.00880	-0.0257	-0.00556	-0.0239	-0.0187
	(0.0332)	(0.0340)	(0.0340)	(0.0347)	(0.0339)
Works 60+ hours per week	0.0443	0.0477	0.0453	0.0475	0.0435
	(0.0399)	(0.0396)	(0.0399)	(0.0397)	(0.0398)
Put off visiting a doctor in last 12	-0.0302*	-0.0163	-0.0285*	-0.0193	-0.0143
months because of cost	(0.0170)	(0.0172)	(0.0173)	(0.0176)	(0.0172)
As Healthy As Others: Definitely (reference)					
Mostly as healthy as others	-0.00523	-0.00461	-0.00704	-0.00692	-0.00504
	(0.0141)	(0.0141)	(0.0146)	(0.0146)	(0.0141)
Neither as healthy as others	-0.070***	-0.0677***	-0.0756***	-0.0736***	-0.0707***
or not	(0.0212)	(0.0212)	(0.0224)	(0.0224)	(0.0212)
Mostly not as healthy as	-0.0448*	-0.0405*	-0.0367	-0.0333	-0.0465**
others	(0.0235)	(0.0234)	(0.0247)	(0.0247)	(0.0234)
Definitely not as healthy as	-0.0600*	-0.0448	-0.0558*	-0.0457	-0.0541*
others	(0.0310)	(0.0309)	(0.0334)	(0.0334)	(0.0310)
Would visit primary healthcare provider with a new health) problem: Definitely (reference					
Probably	-0.0163	-0.0179	-0.0185	-0.0196	-0.0175
	(0.0151)	(0.0151)	(0.0154)	(0.0154)	(0.0150)
Probably not	0.0133	0.0168	0.0178	0.0199	0.0136
	(0.0399)	(0.0400)	(0.0401)	(0.0401)	(0.0402)
Definitely not	-0.0502	-0.0417	-0.0469	-0.0431	-0.0470
	(0.0713)	(0.0709)	(0.0715)	(0.0710)	(0.0712)
Admitted to hospital in last 12	0.0695***	0.0668***	0.0617***	0.0621***	0.0692***
months	(0.0151)	(0.0151)	(0.0161)	(0.0161)	(0.0151)
Firm size: 1-19 employees (reference)					
20-249 employees	-0.00113	-0.00327	0.000848	-0.000702	-0.000947
	(0.0357)	(0.0355)	(0.0357)	(0.0356)	(0.0357)
250+ employees	0.00359	0.00265	0.00642	0.00533	0.00725
	(0.0307)	(0.0306)	(0.0309)	(0.0308)	(0.0309)
Other	-0.0626*	-0.0582*	-0.0568*	-0.0560*	-0.0592*
	(0.0329)	(0.0328)	(0.0331)	(0.0330)	(0.0331)
Constant	0.725***	0.896***	0.777***	0.902***	0.578***
	(0.0983)	(0.104)	(0.101)	(0.110)	(0.0953)
Observations	5,943	5,943	5427	5427	5,940
R-squared	0.034	0.038	0.037	0.039	0.040

Note: Unweighted linear regression predicting whether a person had an ACC claim in the last 12 months, given they had a limiting injury in the last 12 months. Sample restricted to people who had a limiting injury in the last 12 months. Each column treats the age variable differently. The dependent variable equals one if they had an accepted claim with an accident in the 12 months before the SoFIE interview. Full set of controls included.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Appendix D

D Appendices for Chapter 7

D.1 Appendix figures and tables

Table D.1: Robustness check on exclusion of firms thought to be in the Accredited Employer Programme

	Work Claims			Earners' Claims		
VARIABLES	AEP1	AEP2	AEP3	AEP1	AEP2	AEP3
	80% AEP	95% AEP	5% AEP	80% AEP	95% AEP	5% AEP
Dependent variable: Number of claims with treatment costs over $500						
RF*post2011	-0.0156	-0.0222**	-0.0146	-0.0318***	-0.0296***	-0.0330**
	(0.00970)	(0.00924)	(0.00993)	(0.00762)	(0.00751)	(0.00788)
RF*Time trend	-0.00109	-0.00106	-0.00139	0.00501***	0.0042***	0.00415***
	(0.00182)	(0.00168)	(0.00188)	(0.00158)	(0.00141)	(0.00160)
Constant	-0.0252	0.00335	-0.0729	0.631***	0.807***	0.595***
	(0.102)	(0.0989)	(0.107)	(0.111)	(0.113)	(0.113)
Controls						
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.042	0.040	0.041	0.080	0.072	0.079
Observations	49,722	52,428	47,385	49,722	52,428	47,385
Number of firms	7,821	8,229	7,578	7,821	8,229	7,578
Mean log claims	0.0684	0.7095	0.6795	1.2791	1.3275	1.2641

Note: In the main analysis, firms are assumed to be in the Accredited Employers Programme (AEP) and therefore excluded from the experience rating sample if more than 80% of their claims are flagged as AEP claims. This table tests different thresholds. It indicates that the results are not sensitive to how this is defined. This inverse hyperbolic sine regression contains the full set of controls (firm characteristics, year fixed effects and firm fixed effects). The dependent variable is claims with treatment costs greater than $500.

*** p<0.01, ** p<0.05, * p<0.1

Table D.2: Inverse hyperbolic sine transformation regression of firms predicting the rate of injury claims with treatment costs over $500 per 1,000 employees

Sample:	**Work Claims**				**Earners' Claims**			
VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Rate of claims with treatment costs greater than $500 per 1,000 employees								
RF*Post2011	-0.0358**	-0.0113	-0.0247*	-0.0108	-0.0364**	-0.0298**	-0.00710	-0.00328
	(0.0148)	(0.0143)	(0.0135)	(0.0235)	(0.0149)	(0.0148)	(0.0134)	(0.0229)
RF	0.410***	0.595***			0.982***	0.901***		
	(0.0233)	(0.0217)			(0.0214)	(0.0254)		
RF*Time trend				-0.00295				-0.000813
				(0.00418)				(0.00410)
Employees (hundreds)	-0.0460***	-0.0602***	0.102***	0.102***	-0.162***	-0.151***	0.0682***	0.0682***
	(0.00914)	(0.00784)	(0.0198)	(0.0198)	(0.0101)	(0.0111)	(0.0177)	(0.0177)
Multi-site firm		0.120***	0.274***	0.273***		0.257***	0.305***	0.305***
		(0.0310)	(0.0646)	(0.0646)		(0.0302)	(0.0674)	(0.0674)
Employee turnover		0.000888	-0.00151	-0.00151		-0.00393***	-0.00149	-0.00149
		(0.00102)	(0.00117)	(0.00117)		(0.00106)	(0.00131)	(0.00131)
Monthly earning >$10,000+								
% earning $5-$10,000		0.0287***	0.00774**	0.00758**		0.00553*	-0.00171	-0.00175
		(0.00351)	(0.00333)	(0.00334)		(0.00318)	(0.00363)	(0.00365)
% earning $2-$5,000		0.0343***	0.00801***	0.00783**		0.00348	-0.00279	-0.00284
		(0.00307)	(0.00305)	(0.00306)		(0.00277)	(0.00337)	(0.00339)
% earning $1-$2,000		0.0408***	0.0137***	0.0136***		0.00470	0.00340	0.00337
		(0.00337)	(0.00355)	(0.00355)		(0.00312)	(0.00411)	(0.00412)
% earning <$1,000		0.0394***	0.0119***	0.0118***		0.00385	-0.00576	-0.00581
		(0.00320)	(0.00356)	(0.00356)		(0.00303)	(0.00409)	(0.00411)
% Male		0.0142***	0.00442***	0.00443***		0.00132*	0.00280*	0.00280*
		(0.000763)	(0.00121)	(0.00121)		(0.000796)	(0.00156)	(0.00156)
% Aged<=25		0.00121	0.00332**	0.00333**		0.00921***	0.00653***	0.00653***
		(0.00121)	(0.00153)	(0.00153)		(0.00131)	(0.00184)	(0.00184)
% Aged>60		-0.00305**	-0.00145	-0.00146		-0.00788***	-0.00584***	-0.00585***
		(0.00130)	(0.00189)	(0.00189)		(0.00161)	(0.00216)	(0.00216)
Enterprise Age <=5 years								
5-10 years		-0.00917	0.0618	0.0618		0.0883	0.169**	0.169**
		(0.0777)	(0.0851)	(0.0851)		(0.0761)	(0.0826)	(0.0826)

10-15 years		-0.0110	0.190*	0.190*		0.0764	0.203**	0.203**
		(0.0860)	(0.104)	(0.104)		(0.0834)	(0.100)	(0.100)
>15 years		-0.0795	0.170	0.172		-0.101	0.0832	0.0836
		(0.108)	(0.128)	(0.128)		(0.106)	(0.126)	(0.126)
Enterprise size (firm=enterprise)								
Small		-0.456***	-0.232***	-0.232***		-0.475***	-0.367***	-0.367***
		(0.0423)	(0.0849)	(0.0849)		(0.0482)	(0.0845)	(0.0845)
Medium low		-0.269***	-0.191***	-0.191***		-0.295***	-0.145**	-0.145**
		(0.0384)	(0.0700)	(0.0700)		(0.0400)	(0.0668)	(0.0668)
Medium high		-0.128***	-0.0323	-0.0332		-0.204***	0.0190	0.0188
		(0.0442)	(0.0760)	(0.0760)		(0.0458)	(0.0748)	(0.0748)
Large		-0.200***	-0.0573	-0.0579		-0.174***	-0.0627	-0.0628
		(0.0469)	(0.0892)	(0.0892)		(0.0506)	(0.0931)	(0.0931)
Constant	1.933***	-2.141***	0.485	0.501	2.961***	1.885***	2.578***	2.582***
	(0.0300)	(0.327)	(0.337)	(0.337)	(0.0288)	(0.301)	(0.389)	(0.390)
Controls								
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Level 2		Yes				Yes		
Firm fixed effects			Yes	Yes			Yes	Yes
R-squared	0.027	0.117	0.004	0.004	0.134	0.169	0.012	0.012
Observations	49,722	49,722	49,722	49,722	49,722	49,722	49,722	49,722
Number of firms			7821	7821			7821	7821
Mean dependent variable	1.9529	1.9529	1.9529	1.9529	3.1757	3.1757	3.1757	3.1757

Note: This table displays the results of a log linear regression looking at whether the degree of experience rating (RF) is associated with the rate of work injury claims per 1,000 employees following the introduction of experience rating (post2011). Additional controls are at the end. The regressions in this table include controls for the number of employees but exclude the quadratic term. The R squared values for the firm fixed effects model are low.

*** p<0.01, ** p<0.05, * p<0.1

Table D.3: Model comparison of predictions of the impact of experience rating on the rate of claims with treatment costs over $500 per 1,000 employees

SAMPLE:	WORK CLAIMS				EARNERS' CLAIMS			
VARIABLES	(4)	(1)	(2)	(3)	(8)	(5)	(6)	(7)
MODEL:	$SINH^{-1}$	LOG-LINEAR	LOG-LINEAR 2	OLS	$SINH^{-1}$	LOG-LINEAR	LOG-LINEAR 2	OLS
WITH FIRM FIXED EFFECTS								
Dependent variable: Rate of claims with treatment costs over $500 per 1,000 employees								
RF*post2011	-0.0108	-0.0147	-0.000490	-0.230	-0.00328	-0.0262***	0.0298	-1.939
	(0.0235)	(0.0118)	(0.0464)	(0.852)	(0.0229)	(0.00789)	(0.0394)	(1.956)
RF*Time trend	-0.00295	0.00479**	-0.00854	0.0187	-0.000813	0.00827***	-0.0122*	0.362*
	(0.00418)	(0.00226)	(0.00825)	(0.119)	(0.00410)	(0.00153)	(0.00705)	(0.198)
Constant	0.501	2.702***	-3.417***	-8.529	2.582***	3.885***	0.337	2.374
	(0.337)	(0.257)	(0.633)	(8.084)	(0.390)	(0.187)	(0.665)	(24.65)
R-Squared	0.004	0.015	0.005	0.002	0.012	0.032	0.010	0.005
WITHOUT FIRM FIXED EFFECTS								
Dependent variable: Rate of claims with treatment costs over $500 per 1,000 employees								
RF*post2011	-0.0366	-0.000180	-0.0501	-0.0186	-0.0211	-0.0198**	-0.00665	-1.017
	(0.0237)	(0.0131)	(0.0467)	(0.685)	(0.0233)	(0.00911)	(0.0405)	(1.139)
RF*Time trend	0.00511	0.00606**	0.00823	-0.0256	-0.00176	0.00944***	-0.0129*	-0.144
	(0.00426)	(0.00254)	(0.00842)	(0.108)	(0.00428)	(0.00185)	(0.00758)	(0.362)
RF	0.577***	-0.615***	1.442***	-1.135	0.907***	-0.334***	1.896***	3.915
	(0.0266)	(0.0186)	(0.0529)	(1.422)	(0.0283)	(0.0135)	(0.0522)	(5.831)
Constant	-2.150***	2.357***	-8.846***	-6.397	1.888***	4.498***	-1.379***	38.22***
	(0.328)	(0.361)	(0.630)	(10.75)	(0.302)	(0.148)	(0.535)	(8.972)
R-Squared	0.117	0.558	0.149	0.039	0.169	0.245	0.198	0.014
CONTROLS								
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,722	25,167	49,722	49,722	49,722	35,298	49,722	49,722
Mean dependent variable	1.9529	3.1629	-0.6717	18.8005	3.1757	3.7821	1.3495	41.1709

Note: This table compares the results from the log-linear, ols and inverse hyperbolic sine models. The negative binomial and Poisson quasi-maximum likelihood models are not included here because rates are not a count variable. Two version of log-linear are used, in the first model firms with no claims are dropped from the sample, in the second they are assigned a claims rate of 0.01.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table D.4: Inverse hyperbolic sine transformation regression predicting claim rates per 1,000 employees for firms by type of claim

SAMPLE:	**WORK CLAIMS**				**EARNERS' CLAIMS**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	*Rate of treatment only claims per 1,000 employees*	*Rate of total claims per 1,000 employees*	*Rate of weekly compensation claims per 1,000 employees*	*Rate of average days off work per weekly compensation claim per 1,000 employees*	*Rate of treatment only claims per 1,000 employees*	*Rate of total claims per 1,000 employees*	*Rate of weekly compensation claims per 1,000 employees*	*Rate of average days off work per weekly compensation claim per 1,000 employees*
VARIABLES								
RF*post2011	0.0107	0.0128	0.00497	0.0121	0.0235	0.0280	0.0301	0.0560***
	(0.0191)	(0.0184)	(0.0223)	(0.0301)	(0.0199)	(0.0194)	(0.0225)	(0.0196)
RF*Time trend	-0.00176	-0.00219	-0.00672*	-0.00613	0.00455	0.00436	-0.00559	-0.0125***
	(0.00363)	(0.00351)	(0.00407)	(0.00539)	(0.00398)	(0.00387)	(0.00403)	(0.00353)
Constant	2.975***	3.108***	1.282***	7.088***	5.807***	5.750***	1.209***	6.941***
	(0.347)	(0.345)	(0.301)	(0.700)	(0.440)	(0.445)	(0.361)	(0.436)
Controls								
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.010	0.011	0.012	0.015	0.008	0.010	0.010	0.018
Observations	49,722	49,722	49,722	49,722	49,722	49,722	49,722	49,722
Number of firms	7,824	7,824	7,824	7,824	7,824	7,824	7,824	7,824
Mean log claim rate	4.7544	4.9495	1.8342	3.2923	5.7520	5.8948	2.3149	4.0666

Note: Each column represents a separate regression. Controls include year and firm fixed effects, industry level 2 and firm characteristics. The first group of columns is based on work claims while the second group of columns is based on off-the-job claims for workers.

**** p<0.01, ** p<0.05, * p<0.1*

Table D.5: Model comparison results for regressions predicting number of claims with costs of treatment greater than $500 to test for parallel trends in the pre-treatment period (2006-2011)

Sample:	**Work Claims**					**Earners' Claims**				
	Log-Linear		Inverse hyperbolic sine		Poisson QML	Log-Linear		Inverse hyperbolic sine		Poisson QML
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Dependent variable: Number of claims with treatment costs greater than $500									
RF*Time trend	0.00335	0.00154	0.00463**	0.00127	0.00509	0.00615***	0.00438**	0.00751***	0.00686***	-0.00286
	(0.00271)	(0.00277)	(0.00232)	(0.00217)	(3.994)	(0.00204)	(0.00213)	(0.00201)	(0.00194)	(2.403)
RF	0.239***		0.316***		0.700***	0.546***		0.729***		0.762***
	(0.0211)		(0.0193)		(0.0489)	(0.0211)		(0.0205)		(0.0335)
Constant	-2.267***	-0.557	-1.683***	0.0759	-5.707**	-0.647***	0.0728	-0.207	0.477***	-2.683***
	(0.501)	(0.493)	(0.266)	(0.163)	(2.337)	(0.185)	(0.287)	(0.160)	(0.175)	(0.455)
Controls										
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employees squared	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry level 2	Yes		Yes		Yes	Yes		Yes		Yes
Firm fixed effects		Yes		Yes			Yes		Yes	
R-squared	0.385	0.040	0.390	0.030	0.444	0.664	0.100	0.661	0.080	0.684
Observations	16,086	16,086	31,755	31,755	31,755	22,305	22,305	31,755	31,755	31,755
Number of firms		5,937		7,824			6,813		7,824	
Mean dependent variable	0.52841	0.52841	0.6834	0.6834	1.2061	1.0087	1.0087	1.2564	1.2564	3.5270

Note: These regressions include controls for firm characteristics and year fixed effects. Columns 1, 3, 5, 6, 8 and 10 include detailed industry fixed effects (level 2). Columns 2, 4, 7 and 9 include firm fixed effects but exclude industry. Includes controls for number of employees and its quadratic.

*** p<0.01, ** p<0.05, * p<0.1

Table D.6: Model comparison results for regressions predicting the rate of claims with costs of treatment greater than $500 per 1,000 employees to test for parallel trends in the pre-treatment period (2006-2011)

Sample:	**Work Claims**				**Earners' Claims**			
	Log-Linear		Inverse hyperbolic sine		Log-Linear		Inverse hyperbolic sine	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Rate of claims with treatment costs greater than $500 per 1,000 employees								
RF*Time trend	0.00722**	0.00389	0.00653	-0.00009	0.0115***	0.00917***	-0.00490	-0.00357
	(0.00305)	(0.00282)	(0.00495)	(0.00490)	(0.00220)	(0.00189)	(0.00502)	(0.00488)
RF	-0.663***		0.648***		-0.368***		0.979***	
	(0.0196)		(0.0290)		(0.0159)		(0.0325)	
Constant	2.855***	2.740***	-2.278***	1.359**	4.484***	3.585***	1.187***	2.346***
	(0.529)	(0.438)	(0.557)	(0.597)	(0.226)	(0.347)	(0.404)	(0.648)
Controls								
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employees squared								
Industry level 2	Yes		Yes		Yes		Yes	
Firm fixed effects		Yes		Yes		Yes		Yes
R-squared	0.566	0.013	0.121	0.003	0.266	0.048	0.175	0.017
Observations	16,086	16,086	31,755	31,755	22,305	22,305	31,755	31,755
Number of firms		5,937		7,824		6,813		7,824
Mean dependent variable	3.1891	3.1891	1.9682	1.9682	3.7884	3.7884	3.1460	3.1460

Note: These regressions include controls for firm characteristics and year fixed effects. Columns 1, 3, 5 and 7 include detailed industry fixed effects (level 2). Columns 2. 4, 6 and 8 include firm fixed effects but exclude industry. Includes controls for the number of employees but not the quadratic.

*** p<0.01, ** p<0.05, * p<0.1

Table D.7: Model comparison results for placebo test: Regression predicting number of claims with treatment costs greater than $500 in the pre-treatment period

Sample:	Work Claims						Earners' Claims					
	Log-Linear			Inverse hyperbolic sine			Log-Linear			Inverse hyperbolic sine		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		
	Dependent variable: Number of claims with treatment costs greater than $500											
RF*Post2007	0.017*			0.052***			0.035***			0.060***		
	(0.0093)			(0.0113)			(0.0074)			(0.0091)		
RF*Post2008		0.011			0.036***			0.027***			0.039***	
		(0.0087)			(0.0124)			(0.0067)			(0.0101)	
RF*Post2009			-0.012			-0.057***			-0.013**			-0.066***
			(0.0093)			(0.0116)			(0.0063)			(0.0092)
Constant	-0.629	-0.603	-0.408	0.0796	0.0731	0.0813	-0.0208	0.00301	0.283	0.481***	0.474***	0.474***
	(0.493)	(0.494)	(0.481)	(0.162)	(0.163)	(0.162)	(0.282)	(0.285)	(0.285)	(0.174)	(0.175)	(0.175)
Controls												
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employees squared	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.040	0.040	0.040	0.031	0.031	0.031	0.101	0.100	0.100	0.081	0.080	0.080
Observations	16,086	16,086	16,086	31,755	31,755	31,755	22,305	22,305	22,305	31,755	31,755	31,755
Number of firms	5,937	5,937	5,937	7,824	7,824	7,824	6,813	6,813	6,813	7,824	7,824	7,824
Mean dep var	0.5284	0.5284	0.5284	0.6834	0.6834	0.6834	1.0087	1.0087	1.0087	1.2564	1.2564	1.2564

Note: These regressions include controls for firm characteristics, year fixed effects and firm fixed effects. Includes controls for number of employees and its quadratic.

*** p<0.01, ** p<0.05, * p<0.1

Table D.8: Model comparison results for placebo test: Regression predicting rate of claims with treatment costs greater than $500 in the pre-treatment period

Sample:	**Work Claims**						**Earners' Claims**					
	Log-Linear			Inverse hyperbolic sine			Log-Linear			Inverse hyperbolic sine		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dependent variable: Rate of claims with treatment costs greater than $500 per 1,000 employees											
RF*Post2007	0.026***			0.065**			0.050***			-0.070**		
	(0.0094)			(0.0276)			(0.0066)			(0.0278)		
RF*Post2008		0.015*			0.026			0.035***			-0.010	
		(0.0087)			(0.0300)			(0.0059)			(0.0294)	
RF*Post2009			-0.0091			-0.083***			-0.0041			0.084***
			(0.0095)			(0.0284)			(0.0060)			(0.0277)
Constant	2.69***	2.74***	2.95***	1.36**	1.36**	1.37**	3.53***	3.59***	3.87***	2.34***	2.35***	2.34***
	(0.435)	(0.436)	(0.439)	(0.597)	(0.597)	(0.596)	(0.340)	(0.343)	(0.350)	(0.649)	(0.648)	(0.649)
Controls												
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
R-squared	0.013	0.013	0.013	0.003	0.003	0.004	0.050	0.049	0.047	0.017	0.017	0.017
Observations	16,086	16,086	16,086	31,755	31,755	31,755	22,305	22,305	22,305	31,755	31,755	31,755
Number of firms	5,937	5,937	5,937	7,824	7,824	7,824	6,813	6,813	6,813	7,824	7,824	7,824
Mean dep variable	3.1891	3.1891	3.1891	1.9682	1.9682	1.9682	3.7884	3.7884	3.7884	3.1460	3.1460	3.1460

Note: These regressions include controls for firm characteristics, year fixed effects and firm fixed effects. It includes controls for the number of employees but not the quadratic.

*** p<0.01, ** p<0.05, * p<0.1

Table D.9: Log-linear regression of firms predicting the number of injury claims with treatment costs over $500

Sample:	**Work Claims**				**Earners' Claims**			
VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Number of claims Number of claims with treatment costs greater than $500 (log)								
RF*Post2011	-0.0431***	-0.0231***	-0.0196***	-0.0194*	-0.0254***	-0.0236***	-0.0117**	-0.0239***
	(0.00844)	(0.00849)	(0.00730)	(0.0117)	(0.00745)	(0.00716)	(0.00568)	(0.00810)
RF	0.108***	0.188***			0.511***	0.486***		
	(0.0166)	(0.0193)			(0.0194)	(0.0223)		
RF*Time trend				-0.000034				0.00265
				(0.00220)				(0.00168)
Employees (hundreds)	0.169***	0.163***	0.264***	0.264***	0.203***	0.191***	0.382***	0.382***
	(0.0145)	(0.0168)	(0.0177)	(0.0177)	(0.0221)	(0.0231)	(0.0235)	(0.0235)
Employees squared	-0.00003	-0.00003	-0.00004	-0.00004	-0.00004	-0.00004	-0.00007	-0.00007
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Multi-site firm		0.0843***	0.0837***	0.0837***		0.109***	0.0881***	0.0885***
		(0.0165)	(0.0297)	(0.0297)		(0.0143)	(0.0249)	(0.0249)
Employee turnover		0.000859	-0.000182	-0.000183		-0.00154***	-0.00087*	-0.00085*
		(0.000612)	(0.000621)	(0.000621)		(0.00054)	(0.00050)	(0.00050)
Monthly earning >$10,000+								
% earning $5-$10,000		0.0164***	0.00473**	0.00473*		0.00332**	-0.000294	-1.61e-05
		(0.00404)	(0.00240)	(0.00244)		(0.00148)	(0.00171)	(0.00173)
% earning $2-$5,000		0.0174***	0.00285	0.00284		0.00212	-0.000994	-0.000703
		(0.00362)	(0.00230)	(0.00234)		(0.00132)	(0.00167)	(0.00169)
% earning $1-$2,000		0.0212***	0.00305	0.00305		0.00305**	0.000478	0.000696
		(0.00382)	(0.00262)	(0.00265)		(0.00152)	(0.00201)	(0.00201)
% earning <$1,000		0.0160***	0.00136	0.00136		0.00222	-0.00238	-0.00210
		(0.00355)	(0.00275)	(0.00278)		(0.00151)	(0.00208)	(0.00209)
% Male		0.00690***	0.00476***	0.00476***		0.000613*	0.00263***	0.00264***
		(0.000563)	(0.00113)	(0.00113)		(0.000363)	(0.000836)	(0.000836)
% Aged<=25		0.000399	0.000958	0.000958		0.00429***	0.00205***	0.00205***
		(0.000959)	(0.000881)	(0.000882)		(0.000600)	(0.000759)	(0.000759)
% Aged>60		-0.00181**	-0.000520	-0.000520		-0.00286***	-0.00213**	-0.00211**
		(0.000725)	(0.00117)	(0.00117)		(0.000669)	(0.000984)	(0.000984)
Enterprise Age <=5 years								
5-10 years		0.0143	-0.0200	-0.0200		0.00614	-0.0190	-0.0192
		(0.0312)	(0.0343)	(0.0343)		(0.0306)	(0.0296)	(0.0296)
10-15 years		0.0198	-0.0449	-0.0449		0.0299	-0.0205	-0.0216
		(0.0351)	(0.0437)	(0.0437)		(0.0347)	(0.0358)	(0.0358)

>15 years		0.0165	-0.0940*	-0.0940*		0.0216	-0.0411	-0.0435
		(0.0469)	(0.0553)	(0.0555)		(0.0457)	(0.0460)	(0.0460)
Enterprise size (firm=enterprise)								
Small		-0.0779***	-0.0624*	-0.0624*		-0.106***	-0.0788**	-0.0787**
		(0.0172)	(0.0319)	(0.0319)		(0.0175)	(0.0329)	(0.0329)
Medium low		0.0309*	-0.0136	-0.0136		-0.0225	-0.00409	-0.00396
		(0.0182)	(0.0347)	(0.0347)		(0.0167)	(0.0275)	(0.0275)
Medium high		0.111***	0.0160	0.0160		0.0759***	0.110***	0.110***
		(0.0240)	(0.0430)	(0.0431)		(0.0194)	(0.0325)	(0.0326)
Large		0.0826***	-0.0197	-0.0197		-0.0209	0.0795*	0.0800*
		(0.0309)	(0.0520)	(0.0520)		(0.0219)	(0.0458)	(0.0459)
Constant	0.245***	-2.001***	-0.449*	-0.449*	0.476***	-0.0601	0.304	0.277
	(0.0163)	(0.343)	(0.253)	(0.257)	(0.0187)	(0.142)	(0.187)	(0.189)
Controls								
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Level 2		Yes				Yes		
Firm fixed effects			Yes	Yes			Yes	Yes
R-squared	0.292	0.378	0.052	0.052	0.631	0.653	0.099	0.099
Observations	25,167	25,167	25,167	25,167	35,298	35,298	35,298	35,298
Number of firms			6,366	6,366			7,074	7,074
Mean log claims	0.5324	0.5324	0.5324	0.5324	1.0256	1.0256	1.0256	1.0256

Note: This table displays the results of a log-linear regression looking at whether the degree of experience rating (RF) is associated with the number and rate of work injury claims following the introduction of experience rating (post2011). The coefficients for the interaction terms are displayed, along with that for RF. Additional controls are displayed in the bottom panel.

*** p<0.01, ** p<0.05, * p<0.1

D.2 Calculations used in deriving variables

D.2.1 The Rating Factor calculation

The weighting for degree of experience rating (for firms with levies of over $10,000) is described in the experience rating Regulations as follows:

a) if the liable earnings (**LE**) of the levy payer in the experience period are $2,000,000 or less, the weighting is the result of—

$$0.05 \times \sqrt{(LE \div \$2{,}000{,}000)}$$

b) if the liable earnings (**LE**) of the levy payer in the experience period are over $2,000,000 and equal to or under $5,000,000, the weighting is the result of—

$$5\% + \{0.05 \times \sqrt{[(LE - \$2{,}000{,}000) \div \$3{,}000{,}000]}\}$$

c) if the liable earnings (**LE**) of the levy payer in the experience period are over $5,000,000 and equal to or under $10,000,000, the weighting is the result of—

$$10\% + \{0.05 \times \sqrt{[(LE - \$5{,}000{,}000) \div \$5{,}000{,}000]}\}$$

d) if the liable earnings (**LE**) of the levy payer in the experience period are over $10,000,000 and equal to or under $20,000,000, the weighting is the result of—

$$15\% + \{0.05 \times \sqrt{[(LE - \$10{,}000{,}000) \div \$10{,}000{,}000]}\}$$

e) if the liable earnings (**LE**) of the levy payer in the experience period are over $20,000,000 and equal to or under $50,000,000, the weighting is the result of—

$$20\% + \{0.1 \times \sqrt{[(LE - \$20{,}000{,}000) \div \$30{,}000{,}000]}\}$$

f) if the liable earnings (**LE**) of the levy payer in the experience period are over \$50,000,000 and equal to or under \$100,000,000, the weighting is the result of—

$$30\% + \{0.1 \times \sqrt{[(LE - \$50{,}000{,}000) \div \$50{,}000{,}000]}\}$$

g) if the liable earnings (**LE**) of the levy payer in the experience period are over \$100,000,000 and equal to or under \$200,000,000, the weighting is the result of—

$$40\% + \{0.1 \times \sqrt{[(LE - \$100{,}000{,}000) \div \$100{,}000{,}000]}\}$$

h) if the liable earnings (**LE**) of the levy payer in the experience period are over \$200,000,000 and equal to or under \$1,350,000,000, the weighting is the result of—

$$50\% + \{0.5 \times \sqrt{[(LE - \$200{,}000{,}000) \div \$1{,}150{,}000{,}000]}\}$$

i) if the liable earnings of the levy payer in the experience period are over \$1,350,000,000, the weighting is 100%.

D.2.2 Liable earnings

The calculation for liable earnings is:

- Total gross earnings paid to employees (from IR348 PAYE schedules)
- Less total earnings not liable for levies such as redundancy payments or pensions
- Less other payments not liable, such as payments to contractors who meet their own ACC liabilities
- Less total excess paid to employees over the maximum (for example, in 2008 the maximum individual employee earnings was \$99,817.25).
- Less payments to employees for the first week of work injury

Appendix E

E Appendices for Chapter 8

E.1 Appendix figures and tables

Table E.1: Full regression results of lost-time injuries OLS estimates of the "Monday Effect" from linear probability models by type of injuries

VARIABLES	Work Strain & Sprain	Off-the-Job Strain & Sprain	Work Fractures	Off-the-Job Fractures	Work Contusions	Off-the-Job Contusions
Day of week (ref: Thursday)						
Sunday	0.00346	-0.0431***	0.00400	0.0334***	0.000897	0.00325***
	(0.00406)	(0.00250)	(0.00276)	(0.00231)	(0.00202)	(0.00119)
Monday	0.0188***	0.0170***	-0.00467***	-0.0137***	-0.00259**	0.00217
	(0.00261)	(0.00290)	(0.00173)	(0.00257)	(0.00126)	(0.00137)
Tuesday	0.00640**	0.0161***	-0.00203	-0.0133***	0.000673	0.000594
	(0.00261)	(0.00297)	(0.00174)	(0.00264)	(0.00128)	(0.00139)
Wednesday	0.00558**	0.0109***	0.000523	-0.00684***	0.00123	0.00161
	(0.00263)	(0.00293)	(0.00176)	(0.00262)	(0.00129)	(0.00138)
Friday	0.00366	-0.0373***	0.00149	0.0327***	-0.00326**	0.00181
	(0.00270)	(0.00280)	(0.00182)	(0.00261)	(0.00130)	(0.00134)
Saturday	0.000574	-0.0178***	0.00909***	0.0326***	-0.000364	0.00156
	(0.00355)	(0.00239)	(0.00245)	(0.00219)	(0.00175)	(0.00113)
Year (ref: 2001)						
2002	0.00426	-0.00446	-0.00965***	-0.00474	0.00412*	0.00536***
	(0.00426)	(0.00393)	(0.00299)	(0.00379)	(0.00210)	(0.00194)
2003	-0.00135	-0.0295***	-0.00453	0.000879	-0.00180	-0.00388**
	(0.00421)	(0.00383)	(0.00298)	(0.00375)	(0.00203)	(0.00184)
2004	0.0126***	-0.0223***	-0.00288	0.00642*	-0.00359*	-0.00635***
	(0.00420)	(0.00382)	(0.00297)	(0.00372)	(0.00200)	(0.00181)
2005	0.0415***	0.00194	-0.00800***	0.00327	0.00663***	0.00512***
	(0.00423)	(0.00382)	(0.00294)	(0.00368)	(0.00208)	(0.00188)
2006	0.0497***	0.00814**	-0.0160***	-0.0130***	0.00799***	0.00599***
	(0.00423)	(0.00377)	(0.00290)	(0.00359)	(0.00209)	(0.00185)
2007	0.0588***	0.0178***	-0.0217***	-0.0301***	0.00854***	0.00716***
	(0.00425)	(0.00371)	(0.00288)	(0.00350)	(0.00211)	(0.00182)
2008	0.0739***	0.0122***	-0.0170***	-0.0195***	0.00465**	0.000501
	(0.00432)	(0.00370)	(0.00295)	(0.00351)	(0.00210)	(0.00178)
2009	0.0774***	0.00990***	-0.0138***	0.00125	0.00309	-0.00658***
	(0.00449)	(0.00380)	(0.00308)	(0.00363)	(0.00217)	(0.00178)
2010	0.0696***	-0.000669	-0.00715**	0.00430	0.00830***	-0.00680***

	(0.00461)	(0.00386)	(0.00321)	(0.00370)	(0.00228)	(0.00180)
2011	0.0666***	-0.00250	-0.00504	0.00287	0.0115***	-0.00382**
	(0.00467)	(0.00391)	(0.00327)	(0.00374)	(0.00235)	(0.00185)
2012	-0.0194***	0.0123***	-0.0199***	-0.00884**	-0.00615***	-0.00174
	(0.00457)	(0.00390)	(0.00318)	(0.00369)	(0.00217)	(0.00185)
2013	-0.0368***	0.0177***	-0.0285***	-0.0187***	-0.00603***	0.00175
	(0.00450)	(0.00388)	(0.00308)	(0.00364)	(0.00215)	(0.00186)
2014	-0.0165***	0.0142***	-0.0339***	-0.0242***	-0.00767***	0.00107
	(0.00444)	(0.00384)	(0.00299)	(0.00360)	(0.00209)	(0.00184)
2015	0.000636	0.0281***	-0.0368***	-0.0184***	-0.00816***	0.00266
	(0.00441)	(0.00492)	(0.00294)	(0.00445)	(0.00206)	(0.00237)
2016	0.0211***	0.0177***	-0.0390***	-0.0134***	-0.00249	0.0101***
	(0.00541)	(0.00542)	(0.00348)	(0.00489)	(0.00256)	(0.00266)
Observable characteristics						
Male	-0.0585***	-0.0413***	0.00341**	-0.0103***	-0.0104***	-0.00839***
	(0.00215)	(0.00165)	(0.00138)	(0.00150)	(0.00108)	(0.000791)
Age (to nearest year)	0.000488***	0.00102***	-0.000221***	-0.00165***	0.000270***	0.000374***
	(5.95e-05)	(4.87e-05)	(4.25e-05)	(4.60e-05)	(3.00e-05)	(2.45e-05)
Weekly benefits (hundreds)	0.00417***	0.00907***	0.00396***	-0.00998***	-0.000173	-0.000191
	(0.000366)	(0.000320)	(0.000227)	(0.000288)	(0.000174)	(0.000149)
Industry (ref: Healthcare & Social Assistance)						
Agriculture, Forestry & Fishing	-0.0540***	-0.0135	0.0611***	0.0116	0.00918***	-0.0114**
	(0.00526)	(0.0106)	(0.00350)	(0.00939)	(0.00258)	(0.00524)
Mining	-0.0462***	0.0234	0.0410***	-0.00155	0.0241***	-0.00956
	(0.0133)	(0.0354)	(0.00946)	(0.0281)	(0.00730)	(0.0167)
Manufacturing	-0.0726***	0.0108	0.000196	-0.0132*	-0.00259	-0.00421
	(0.00450)	(0.00888)	(0.00269)	(0.00755)	(0.00215)	(0.00448)
Electricity, Gas, Water & Waste Supply	0.00158	0.0207	0.0177***	-0.00399	0.00961**	0.00652
	(0.00929)	(0.0222)	(0.00574)	(0.0183)	(0.00455)	(0.0118)
Construction	-0.0101**	0.0157*	0.0347***	-0.0151**	-0.00131	-0.0121***
	(0.00478)	(0.00884)	(0.00294)	(0.00757)	(0.00225)	(0.00434)
Wholesale Trade	0.00176	0.00734	0.0183***	0.00910	0.00344	-0.00866
	(0.00607)	(0.0130)	(0.00372)	(0.0113)	(0.00289)	(0.00624)
Retail Trade	-0.00444	0.00828	0.0125***	-0.000188	0.00100	-0.00744

	(0.00488)	(0.0102)	(0.00287)	(0.00891)	(0.00233)	(0.00502)
Accommodation & Food Services	-0.0749***	-0.0395***	0.0343***	0.0111	-0.000741	-0.00803
	(0.00579)	(0.0114)	(0.00360)	(0.0104)	(0.00277)	(0.00572)
Transport, Postal & Warehousing	0.0129**	0.0232*	0.0417***	-0.0236**	0.0177***	-7.43e-05
	(0.00520)	(0.0124)	(0.00322)	(0.0101)	(0.00257)	(0.00637)
Information Media & Telecommunications	0.0676***	-0.0164	-4.16e-05	0.0537*	0.0233***	-0.0229*
	(0.0111)	(0.0301)	(0.00626)	(0.0280)	(0.00592)	(0.0121)
Financial & Insurance Services	-0.0759***	-0.0421**	0.0387***	0.0122	0.00303	-0.0182**
	(0.0162)	(0.0166)	(0.0112)	(0.0147)	(0.00795)	(0.00739)
Rental, Hiring & Real Estate Services	-0.0202***	-0.0309*	0.0403***	0.0338**	0.0118***	-0.0154**
	(0.00604)	(0.0159)	(0.00394)	(0.0146)	(0.00299)	(0.00732)
Professional, Scientific & Technical Services	-0.0290***	-0.0341***	0.0506***	0.0276***	0.00191	-0.0186***
	(0.00853)	(0.0119)	(0.00596)	(0.0107)	(0.00399)	(0.00540)
Administrative & Support Services	-0.00737	-0.00705	0.0609***	0.0185	-0.000246	-0.00286
	(0.00735)	(0.0159)	(0.00502)	(0.0142)	(0.00348)	(0.00814)
Public Administration & Safety	-0.0101	-0.00417	0.0314***	0.0185***	0.0151***	-0.00507
	(0.00618)	(0.00802)	(0.00399)	(0.00687)	(0.00308)	(0.00404)
Education & Training	0.0334***	0.0374***	-0.0145***	-0.0269**	-0.000137	-0.00637
	(0.00533)	(0.0136)	(0.00289)	(0.0111)	(0.00253)	(0.00655)
Arts & Recreation Services	0.00627	-0.0241*	0.0908***	0.0223*	0.00707**	-0.0145**
	(0.00660)	(0.0129)	(0.00478)	(0.0115)	(0.00320)	(0.00597)
Other Services	-0.00658	0.0375**	0.0707***	-0.0292**	0.00579	-0.00920
	(0.00806)	(0.0161)	(0.00580)	(0.0136)	(0.00386)	(0.00742)
Industry Not Applicable	-0.0105	-0.0169	0.0428***	-0.00443	0.00460	-0.0135**
	(0.00809)	(0.0129)	(0.00538)	(0.0112)	(0.00377)	(0.00613)
Occupation (ref: Plant and machine operators & assemblers)						
Agriculture & fishery workers	-0.0306***	-0.0138***	0.0417***	0.00959***	0.00623***	-0.00382***
	(0.00365)	(0.00294)	(0.00267)	(0.00278)	(0.00183)	(0.00148)
Clerks	0.0484***	0.00605*	-0.00651**	0.0188***	-0.00246	-0.0103***
	(0.00502)	(0.00323)	(0.00307)	(0.00300)	(0.00245)	(0.00157)
Elementary occupations	0.0220***	-0.0103***	-2.63e-06	0.00499**	0.00125	0.00122
	(0.00267)	(0.00265)	(0.00168)	(0.00247)	(0.00129)	(0.00136)
Legislators, administrators & manager	0.0143***	0.000629	0.0254***	0.0273***	-0.00417*	-0.0195***
	(0.00518)	(0.00327)	(0.00360)	(0.00300)	(0.00245)	(0.00148)

None & missing	-0.0723***	-0.0577***	-0.00693**	-0.0407***	-0.00514**	-0.0101***
	(0.00425)	(0.00287)	(0.00280)	(0.00267)	(0.00207)	(0.00142)
Professionals	-0.0157***	-0.00658**	0.0197***	0.0255***	-0.00735***	-0.0183***
	(0.00446)	(0.00287)	(0.00305)	(0.00263)	(0.00211)	(0.00135)
Service & sales workers	0.0445***	0.00458*	-0.00862***	0.0117***	-0.00198	-0.00617***
	(0.00380)	(0.00259)	(0.00235)	(0.00240)	(0.00184)	(0.00128)
Technicians & associate professionals	0.00469	0.0146***	0.0125***	0.0101***	-0.00245	-0.0148***
	(0.00427)	(0.00287)	(0.00290)	(0.00261)	(0.00208)	(0.00136)
Trades workers	-0.0112***	0.0109***	0.00260	0.0127***	-0.00600***	-0.00503***
	(0.00267)	(0.00240)	(0.00174)	(0.00221)	(0.00122)	(0.00117)
Ethnicity (ref: European only)						
Māori only	0.00751***	0.0302***	-0.0206***	-0.0425***	0.0107***	0.0145***
	(0.00251)	(0.00234)	(0.00158)	(0.00210)	(0.00128)	(0.00122)
Pacific only	-0.00750**	0.0262***	-0.0124***	-0.0436***	0.00882***	0.00934***
	(0.00373)	(0.00321)	(0.00233)	(0.00289)	(0.00187)	(0.00162)
Asian only	0.0112***	0.0280***	-0.00235	-0.0372***	0.0162***	0.0189***
	(0.00377)	(0.00364)	(0.00246)	(0.00322)	(0.00196)	(0.00191)
Middle Eastern, Latin American or African (MELAA) only	0.0319***	0.0212**	-0.00751	-0.0424***	0.00533	0.000272
	(0.00889)	(0.00841)	(0.00572)	(0.00751)	(0.00424)	(0.00385)
Other (single ethnicity)	0.0226***	0.0232***	-0.0112***	-0.0267***	-0.00202	-0.000919
	(0.00610)	(0.00499)	(0.00400)	(0.00445)	(0.00282)	(0.00228)
European & Māori	0.0164***	0.0276***	-0.0153***	-0.0313***	0.00581***	0.00363***
	(0.00310)	(0.00248)	(0.00200)	(0.00228)	(0.00151)	(0.00118)
European & Pacific	0.0347***	0.0461***	-0.0217***	-0.0441***	0.00462	-0.00399
	(0.00972)	(0.00680)	(0.00590)	(0.00610)	(0.00457)	(0.00296)
European & Asian	0.00782	-0.00820	-0.00816	-0.0307**	0.00556	0.00301
	(0.0199)	(0.0139)	(0.0129)	(0.0131)	(0.00963)	(0.00660)
European & MELAA	0.0121	-0.0111*	-0.00918*	-0.00504	-0.00239	0.00298
	(0.00752)	(0.00581)	(0.00495)	(0.00563)	(0.00342)	(0.00282)
European & Other	0.00117	0.00815	-0.0132	-0.00883	0.0227**	0.00349
	(0.0166)	(0.0136)	(0.0111)	(0.0126)	(0.00922)	(0.00661)
Māori & Pacific	-0.0146	0.0361***	-0.0141*	-0.0426***	0.000512	0.00586
	(0.0120)	(0.00932)	(0.00754)	(0.00850)	(0.00561)	(0.00454)
Māori & Asian	0.0412	0.0689**	-0.0385**	-0.0322	-0.00414	-0.0198*
	(0.0368)	(0.0322)	(0.0192)	(0.0290)	(0.0165)	(0.0116)

Māori & MELAA	-0.00617	0.0231	-0.00639	-0.0195	0.00435	-0.00371
	(0.0227)	(0.0208)	(0.0152)	(0.0194)	(0.0113)	(0.00952)
Māori & Other	-0.0259	0.0746	0.0235	0.0240	0.0244	0.00479
	(0.0454)	(0.0487)	(0.0343)	(0.0446)	(0.0261)	(0.0226)
Pacific & Asian	0.0358**	0.0708***	-0.0231**	-0.0663***	0.0261***	0.0229***
	(0.0178)	(0.0166)	(0.0103)	(0.0140)	(0.00966)	(0.00886)
Pacific & MELAA	0.0756**	0.0462	-0.0228	-0.0529**	0.0143	0.00808
	(0.0351)	(0.0297)	(0.0212)	(0.0263)	(0.0179)	(0.0147)
Pacific & Other	-0.0995	-0.0337	0.0842	-0.0355	-0.0511***	-0.0277
	(0.103)	(0.0652)	(0.0965)	(0.0625)	(0.00258)	(0.0204)
Asian & MELAA	-0.0312	0.0125	-0.0368**	-0.0230	0.0405**	0.00736
	(0.0284)	(0.0298)	(0.0160)	(0.0274)	(0.0175)	(0.0144)
Asian & Other	0.133*	0.00666	-0.0978***	-0.0840*	-0.00821	0.0406
	(0.0744)	(0.0541)	(0.0235)	(0.0458)	(0.0318)	(0.0329)
MELAA & Other	0.151***	0.0397	-0.0766***	0.0865*	-0.000200	-0.00396
	(0.0535)	(0.0514)	(0.0234)	(0.0520)	(0.0235)	(0.0220)
European, Māori & Pacific	0.0454	0.0931**	-0.0172	-0.0717**	0.0344	-0.0110
	(0.0470)	(0.0375)	(0.0278)	(0.0306)	(0.0270)	(0.0147)
European, Māori & Asian	0.0213	0.0280***	-0.00870	-0.0427***	0.0184***	0.000140
	(0.0134)	(0.0100)	(0.00868)	(0.00918)	(0.00706)	(0.00461)
European, Māori & MELAA	0.0327	0.0940***	-0.0290	-0.0394*	0.0152	0.00602
	(0.0321)	(0.0233)	(0.0187)	(0.0205)	(0.0166)	(0.0110)
European, Māori & Other	0.0264	-0.0188	-0.0100	-0.0172	0.0181**	0.00970
	(0.0165)	(0.0134)	(0.0107)	(0.0131)	(0.00879)	(0.00703)
European, Pacific & Asian	0.0725**	0.0148	-0.0167	-0.0704***	-0.00327	0.0221
	(0.0364)	(0.0298)	(0.0229)	(0.0256)	(0.0159)	(0.0166)
European, Pacific & MELAA	-0.0256	0.0507	-0.0173	-0.0873***	0.0318	0.00623
	(0.0432)	(0.0355)	(0.0274)	(0.0295)	(0.0252)	(0.0168)
European, Pacific & Other	0.0233	0.0529	-0.00351	-0.0813***	-0.00495	0.0165
	(0.0437)	(0.0333)	(0.0284)	(0.0278)	(0.0191)	(0.0171)
European, MELAA & Other	-0.000958	0.0789**	0.00225	-0.0797**	0.0289	0.0490**
	(0.0492)	(0.0379)	(0.0331)	(0.0311)	(0.0277)	(0.0231)
Māori, Pacific & Asian	-0.0295	-0.0568	-0.0201	0.0496	0.0570	-0.0149
	(0.0774)	(0.0614)	(0.0510)	(0.0651)	(0.0522)	(0.0259)
Māori, Pacific & MELAA	0.121	-0.0426	0.00660	-0.0380	0.0422	-0.0489***
	(0.0867)	(0.0562)	(0.0556)	(0.0553)	(0.0501)	(0.00120)
Pacific, MELAA & Other	0.107*	0.0346	-0.0950***	-0.0413	0.00679	-0.0143

	(0.0587)	(0.0522)	(0.0216)	(0.0481)	(0.0284)	(0.0214)
European, Māori, Pacific & Asian	0.141*	-0.0183	0.0121	-0.0333	0.0197	-0.0108
	(0.0767)	(0.0692)	(0.0493)	(0.0632)	(0.0408)	(0.0311)
European, Māori, Pacific & MELAA	-0.0383	0.00412	-0.0315	0.00219	0.0308	-0.00781
	(0.0559)	(0.0424)	(0.0328)	(0.0414)	(0.0321)	(0.0188)
Other ethnic combinations	-0.0454	0.0615	0.0223	-0.105***	-0.00315	0.0310
	(0.0625)	(0.0452)	(0.0458)	(0.0368)	(0.0286)	(0.0252)
Constant	0.00751***	0.0302***	-0.0206***	-0.0425***	0.0107***	0.0145***
	(0.00251)	(0.00234)	(0.00158)	(0.00210)	(0.00128)	(0.00122)
Observations	376,242	534,381	376,242	534,381	376,242	534,381
R-squared	0.021	0.012	0.016	0.012	0.003	0.003

Notes: The dependent variable in each regression is a dummy variable for the type of injury. The table reports coefficient estimates for the Monday/first Tuesday back from a public holiday dummy variable from several different linear probability regressions that estimate the incidence of each type of injury. Robust-cluster standard errors are in parentheses. Controls for observable characteristics include gender (male=1), age at time of accident, and gross weekly benefits. Industry dummies are level 1 ANZSIC. Occupation dummies are level 1 ANZSCO.

*** p<0.01, ** p<0.05, * p<0.1