ABSTRACT

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Workers' Compensation (WC) is a large social insurance program that provides medical care and cash benefits to workers injured on the job. Each WC claim involves several different parties—the injured worker, employer, doctor, insurer, and, if applicable, a third-party case manager. To date, the literature has primarily focused on worker responses to incentives, and estimates of worker responsiveness to benefit levels in the 1980s are widely cited. Little is known about how other parties respond to incentives or how worker responsiveness may have changed after the WC policy reforms of the 1990s. In response to rising employer costs, many states have passed policy reforms to reduce these costs. In this dissertation, I examine how different actors respond to changing incentives in WC, with a focus on the policy reforms of the 1990s.

In Chapter 2, I complement the WC incidence literature by updating the estimated elasticity of WC receipt with respect to benefits by using data from the 1990s and reconciling the differences between previously published estimates. I find much lower

levels of worker responsiveness, even after controlling for the policies that made it more difficult for workplace injuries to qualify for WC benefits and employers shifted to self-insurance. I also find that increased prevalence of self-insurance reduces the probability a worker will claim WC benefits.

In Chapter 3, I focus on a reform enacted by the state of Ohio that changed incentives to third-party case managers for getting injured workers back to work. During the mid-1990s, the Ohio state insurer contracted out case management services, and the contracts incorporated a large bonus incentive payment intended to reward contractors for reducing claim duration. The bonus payment is essentially a decreasing function of average days away from work, excluding claims extending longer than 15 months. Therefore, duration is predicted to decrease for minor claims and increase for some severe claims so that the claimants remain out of work longer than 15 months and are excluded from the bonus payment calculation. I find contractor responses are consistent with the expected heterogeneous responses of a profit-maximizing firm but inconsistent with the state's intentions.

RESPONSES TO INCENTIVES IN PUBLIC EXPENDITURE PROGRAMS

By

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Chapter 2: The Effect of Workers' Compensation Cash Benefit Levels on Claim Incidence in the 1990s

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Chapter 3: The Impact of Incentives to Reduce Workers' Compensation Claim Duration: Are Third-Party Case Managers Effective?

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Table of Contents

List of Tables

Tables for Chapter 1:

Tables for Chapter 2:

Tables for Chapter 3:

List of Figures

Figures for Chapter 1:

Figures for Chapter 2:

Figures for Chapter 3:

Chapter 1: Incentives in the Workers' Compensation Insurance Program

1.1 Introduction

Workers' Compensation (WC) is a large social insurance program that provides medical care and cash benefits to workers who are injured on the job. The medical care for injured workers costs $26.2 billion each year, nearly two percent of all health care spending in the United States.[1] The cash benefits awarded to injured workers each year are as large as those conferred by many other major social insurance programs, such as Unemployment Insurance (UI), Temporary Assistance for Needy Families (TANF), and Food Stamps.[2] Employers are mandated to provide WC insurance, and nominal costs to employers are greater than those incurred for UI.[3] Similar to UI, benefits and costs for WC vary across states, and state policymakers are concerned that high employer costs will make their state less attractive to business.

Between the late 1980s and early 1990s, employers experienced a particularly large run-up in WC costs. Employer costs rose by over 25 percent between 1987 and their peak in 1993.[4] This growth in costs can be attributed largely to the 44 percent

[1] In 2005, total health care spending in the U.S. was $1,987.7 billion (Centers for Medicare and Medicaid Services).
[2] In 2002, WC cash benefits totaled $28.1 billion (Sengupta et al., 2006), $25.4 billion was spent on TANF (Administration for Children and Families, Department of Health and Human Services), $19 billion on Food Stamps, and $43.3 billion on UI, up from $24.8 billion in UI benefits paid in 2001 (U.S. House of Representatives).
[3] National Compensation Survey, Bureau of Labor Statistics.
[4] Sengupta et al., 2006.

increase in benefits paid during this same time period.[5] In response, more employers turned to self-insurance and many states passed policy reforms in an effort to reduce these employer costs.[6] Several different types of policies were enacted, some of which addressed employer costs directly by deregulating premiums.[7] Other policies sought to decrease employer costs by reducing the total amount of benefits paid to injured workers, either by making it more difficult for benefits to be awarded or by attempting to get injured workers back to work sooner. In some states, such as Ohio, there were sweeping changes to WC. The formerly public-run system was essentially privatized in 1997. Although there is some empirical evidence about the efficacy of these reforms (e.g., Boden and Ruser, 2003; Neumark et al., 2005; Ruser et al., 2004), many unanswered questions remain, and I address two of them in this dissertation. Though many of these policies were intended to reduce claims, the prior research concerning the impact of the policy reforms on the likelihood of claiming WC is inconclusive. Furthermore, there is no other research that examines the impact of self-insurance on the probability a worker claims WC.[8] Perhaps there is no consensus because state WC systems and policies are so nuanced that characterizing the reforms in the same way obscures important differences across states. In Chapter 3, I focus on policy changes in a particular state, and I know of no other paper that carefully considers a single state's WC system in analysis of the policy reforms of the 1990s.

[5] Sengupta et al., 2006.
[6] Sengupta et al., 2006.
[7] Barkume and Ruser, 2001.
[8] Boden and Ruser (2003) examine the impact of the policies on workplace injury rates. Neumark et al. (2004) look at the impact of one particular reform, employers selecting the doctor, on the length and cost of cash benefit claims, not the probability a claim occurs. Using the sample of injured workers from the National Longitudinal Survey of Youth-1979, Ruser et al. (2004) find no impact of the different policies on the probability a workplace injury occurs on injured worker claims cash benefits. However, as dicussed in Chapter 2, their sample may be too small or too young to find an effect.

In this dissertation, I examine the impact of several of these WC policy changes on claiming behavior. In the present chapter, I describe the WC program and the policy environment of the 1990s. I summarize the current literature addressing WC, and show that there is a need for an updated estimated elasticity of benefit receipt in the 1990s. In Chapter 2, I find that the estimated elasticity of WC cash benefit receipt with respect to benefit levels is lower in the 1990s than in the 1980s. This estimate is robust to accounting for the policy reforms of the 1990s and the prevalence of self-insurance. Furthermore, I show that higher rates of self-insurance indeed make workers less likely to claim WC benefits. I find the policy reforms had no effect on the probability a worker claims WC, a result that might arise if there truly is no effect or if characterizing the reforms in such a uniform way obscures important variation in the reforms and the state WC systems. Therefore, in Chapter 3 I examine a change to the WC system in one state.

In Chapter 3, I examine the privatization of WC in the state of Ohio. During the mid-1990s, the Ohio state insurer contracted out case management services, and the contracts incorporated a large bonus incentive payment intended to reward contractors for reducing claim duration. The bonus payment is essentially a decreasing function of average days away from work, excluding claims extending longer than 15 months. Therefore, duration is predicted to decrease for minor claims and increase for some severe claims so that the claimants remain out of work for longer than 15 months and are excluded from the bonus payment calculation. I find that contractor responses are consistent with the heterogeneous responses of a profit-maximizing firm but inconsistent with the state's intentions. In addition to illustrating the importance of carefully designing incentives, Chapter 3 demonstrates the importance of understanding the

nuances of state WC systems and reforms. The results would make little sense without a clear understanding of the bonus payment.

1.2 Background

1.2.1 Workers' Compensation Insurance

Workers' Compensation is regulated by states, with several key features of the program common to all states. States mandate that employers provide WC insurance at the benefit levels set by each state. Workers injured on the job are entitled to medical care for their injury, and once a worker misses one week of work, he or she is eligible to receive cash benefits to replace lost earnings. Cash benefits generally replace two-thirds of pre-injury earnings, subject to a maximum benefit value.

Employers can obtain WC coverage in one of three ways. Employers may purchase insurance from private companies, from the state, or, if the company is large enough, the employer may self-insure.[9] Nationwide, approximately half of all benefits are paid by private insurers, with the other half split approximately evenly between state insurers and self-insured employers (Sengupta et al., 2006). In states that offer all three forms of insurance, the only employers that purchase public insurance are those with loss histories so poor that the company is unable to acquire private insurance. In five states, including Ohio, private insurance is not offered. In these states all smaller employers purchase public insurance and larger employers may self-insure.[10] If an employer purchases WC insurance from a private or public insurer, the premiums are an increasing

[9] Self-insured employers must provide the state-mandated level of benefits.
[10] The five states are Ohio, North Dakota, Washington, West Virginia, and Wyoming. In 2005, nearly 20 percent of the benefits paid in Ohio were paid by self-insured employers (Sengupta, et al., 2006).

function of how risky the employer's business is (base premium) and the employer's loss history (experience rate). For example, in Ohio, the base premium for coal miners is approximately ten times that of university professors.[11] Smaller employers simply pay these base premiums, and WC premiums are experience rated for larger or riskier employers. Experience rated employers with worse than average loss histories pay more than this base rate, and vice versa.

Workers' Compensation claims fall into two commonly used categories: "medical only" and "cash benefits." Those claimants who only receive medical care and return to work within one week are called medical only recipients. Claimants missing more than one week of work are awarded both medical care and cash benefits and are labeled cash benefit recipients. Although cash benefit claims comprise only 20 percent of all claims, they incur nearly 95 percent of benefits—medical care and cash payments (Sengupta et al., 2006). Furthermore, costs are concentrated in a fraction of the cases. Sengupta et al. (2006) estimate that 35 percent of cash beneficiaries are responsible for 80 percent of the costs.

Cash benefits generally replace two thirds of a worker's pre-injury weekly earnings, subject to a maximum that varies across states. A typical cash benefit schedule is depicted in Figure 1-1. In Colorado in 2001, workers earning less than $891 per week receive weekly benefits in the amount of two thirds of their pre-injury earnings until the benefits reach the maximum of $594 per week.[12] The biggest sources of variation across states are the level of the maximum and the share of the workforce who earn enough to

[11] Ohio Bureau of Workers' Compensation 2006 State Fund Manual. The base rate for Coal Miners (Codes 1005, 1016) is $4.52 and $6.82 per $100 of payroll, respectively, whereas the base rate for university professors (Code 8868) is $0.61 per $100 of payroll.

[12] Some states actually have minimum benefit levels (e.g., Ohio) or replace 100 percent of a worker's pre-injury earnings up to a certain point (e.g., California).

be eligible for the maximum benefit. Workers whose earnings place them above the maximum benefit of the WC schedule face average earnings replacement rates between 40 and 50 percent whereas the average earnings replacement rate below the maximum is close to 70 percent. In Table 1-1, Panels A and B depict the variation across states in the generosity of WC benefits, as illustrated by the level of the maximum benefit in 2001. Panel A depicts the ten states with the lowest maximum. In 2001, the most recent year of data used in the analysis in Chapter 2, injured workers in Mississippi receive up to $316 dollars per week. Half of all workers in Mississippi earned enough to place them above the maximum benefit and the average replacement rate in Mississippi was .54. That is, most workers in Mississippi would receive benefits totaling 54 percent of their pre-injury earnings. In contrast, states with high maximum benefits, as depicted in Panel B, have a smaller share of workers earning enough to place them above the maximum benefit, and the average replacement rates are higher, falling between .62 and .79

In Figure 1-2, I illustrate the two margins that are commonly studied in the WC literature—the decision to claim benefits and the decision concerning how long to receive benefits. Consider the decision to claim WC benefits. A worker is injured on the job. The worker's decision to pursue a WC claim occurs when the worker seeks medical care. If the worker pays for the medical care out of pocket or with his or her health insurance, the injury will never enter the WC system. An injured worker might choose not to file for WC if the benefits are not generous, or if the worker is discouraged from filing benefits by his or her employer. Once the worker seeks WC to cover the workplace injury, the doctor becomes the gatekeeper of the WC system. The doctor is considered

the gatekeeper because he or she assigns a diagnosis to the injury and certifies that the injury is work-related.

A claim will end when the injured worker heals completely and returns to work at full capacity, or heals partially and returns to work at a restricted level. In some cases, a worker's condition stabilizes and the physician ascertains that the worker will not improve sufficiently to return to the workplace and is permanently disabled from the injury. In these cases, the injured worker receives permanent benefits. Conflicting motives regarding the length of a claim make it difficult for injured workers, employers, insurers, or state policymakers to influence when a claim will end. A worker who values leisure may wish to remain out of work longer when benefits are more generous (Butler and Worrall, 1985; Krueger, 1991; Meyer et al., 1995; and Neuhauser and Raphael, 2004). Employers and insurers desire shorter claims to reduce costs, and states seek a balance between lowering employer costs, to keep the state attractive for business, and protecting injured workers.

Injured workers, employers, insurers, and state policymakers have different tools at their disposal to influence the duration of a claim. The injured worker may select a doctor who will most likely certify the injury as work-related and allow the worker to remain away from work (Neumark et al., 2005). The employer may attempt to expedite return-to-work by finding ways to accommodate a recovering worker in the workplace (Krueger, 1991). Insurers may directly encourage the worker to go back to work and offer employers suggestions for how an injured worker might be accommodated in the workplace.

1.2.2 Claiming Trends in Workers' Compensation

During the 1980s, benefit receipt patterns remained roughly constant. However, in the 1990s, the incidence rate fell. As shown in Hirsch et al. (1997), the incidence rate of WC receipt hovered around 1.5 between 1977 and 1993. That is, each year about 1.5 percent of all covered workers begin to receive WC cash benefits. However, as shown in Figure 1-3, the incidence rate fell by 40 percent between 1993 and 2001. The incidence rate can fall if fewer injuries occur or if injured workers are less likely to file claims. Injured workers might be less likely to file claims if benefits are less generous, the probability a claim is accepted falls, or if worker responsiveness to benefit levels changed.

Some of this decline in the incidence rate between 1993 and 2001 may reflect that workplaces became safer. As shown in Table 1-2, the injury rate fell in every industry between 1992 and 2001.[13] Columns (1) and (2) contain the injury rates for each industry in 1992 and 2001. In 1992, there were 12.5 injuries per 100 manufacturing workers whereas in 2001 there were only 8.1 injuries per 100 workers. Furthermore, there was a shift in employment toward safer industries in the 1990s. Manufacturing is one of the most dangerous industries and the services industry is one of the safer industries—in 2001 the incidence rate was 4.6 injuries per 100 full-time workers.[14] As shown in Figure 1-4, between 1989 and 2001 there was a shift in employment away from manufacturing and towards services. Whereas in 1989, 26 percent of workers were employed in the manufacturing industry, by 2001 the share fell to 19.5. In contrast, the share of the workforce employed in the services industry rose from 27.2 percent in 1989 to 34 percent

[13] 1992 was the most recent year of data available.
[14] Bureau of Labor Statistics. Incidence rates of nonfatal occupational injuries and illnesses by industry and selected case types, 2001. http://www.bls.gov/iif/oshwc/osh/os/ostb1129.pdf. Viewed April 16, 2008.

in 2001. These improvements in workplace safety likely impacted the incidence rate of WC receipt.

A decline in benefit generosity may also impact the incidence rate; however, benefit generosity did not change much during the 1990s. To illustrate this, in Figure 1-5, I plot mean real expected weekly benefits and average real weekly earnings from 1989 through 2001. To quantify benefit generosity relative to earnings, consider the replacement rate—the ratio of benefits to earnings. The mean replacement rate changed little over the decade, remaining around .65, as shown in Figure 1-6.[15] Therefore, it is unlikely that benefit generosity influenced the decline in the incidence rate.

For the same level of benefits, workers facing a lower probability a claim will be accepted are less likely to receive WC. Therefore, when thinking about explanations for the decline in the incidence rate it is also important to consider changes to the probability a claim will be accepted. During the 1990s, several states enacted policy reforms that made it more difficult for injured workers to be awarded WC benefits. In the next section, I describe some of the trends that led to these policy reforms and then discuss the character of the reforms that reduced the probability a claim would be awarded benefits.

1.2.3 Workers' Compensation Expenditures in the 1990s

From the late 1980s to the early 1990s, the amount paid in WC benefits increased by thirty percent—the amount paid for medical benefits increased by 50 percent whereas the amount paid for cash benefits increased by 20 percent. In Figure 1-7, I plot the total real medical and cash benefits paid between 1987 and 2005, in millions. These increases in

[15] It is not surprising that the replacement rate did not change much during the 1990s. Most states set cash benefit parameters as a function of the state's average weekly earnings.

benefits paid translated into increased costs to employers. Between 1987 and 1992, employer costs for WC increased 22 percent, from $57.9 billion to $70.6 billion, as shown in Figure 1-8. Since WC is a state program, employer costs vary across states. To remain competitive to business, states wish to keep WC costs low to attract and keep business. In reaction to these increased employer costs, more employers turned to self-insurance and several states enacted policy reforms intended to reduce WC spending and, correspondingly, employer costs.

Self-insuring for WC can reduce employer costs in one of two ways. First, safer than average employers might see cost savings from moving to self-insurance. Since WC premiums are not perfectly experienced rated, safer employers subsidize riskier employers. Therefore, by turning to self-insurance, costs fall for the safest employers. Second, and more relevant for this dissertation, self-insurance might also make workplaces safer. Self-insuring employers enjoy all of the increases in workplace safety in the form of lower WC costs, so self-insuring employers have greater motivation to keep injuries from occurring and minimize the severity of injuries. As shown in Figure 1-9, the share of benefits paid by self-insuring employers rose to its peak between 1987 and 1998, a period when WC receipt was declining.

1.2.4 Workers' Compensation Policy Changes

Approximately two-thirds of all states enacted some type of reform to their WC system in the 1990s. Some of these reforms directly addressed employer costs for WC by deregulating premiums or expanding opportunities for self-insurance. Advocates for deregulation argue that by introducing competition, premiums will fall, and 19 states deregulated WC premiums between 1989 and 1995 (Barkume and Ruser, 2001).

Deregulation efforts continued in the second half of the 1990s, including campaigns in New York and Florida. Barkume and Ruser (2001) find that, after deregulation, WC premiums fell by 13.7 percent.[16]

Other changes to WC aimed to reduce costs by making it harder for a claim to enter the WC system or by reducing the amount of time a worker misses from work. Some reforms were intended to impact the incidence of WC receipt whereas others sought to get injured workers to return to work more quickly. In Table 1-3, I present the four most common types of reforms expected to reduce WC receipt, as categorized in Boden and Ruser (2003) and Ruser et al. (2004). Each of these reforms is expected to decrease the number of WC claims, either by discouraging workers from filing claims or making it harder for filed claims to be accepted. Oregon was the first state to pass major WC reforms, and the legislative changes were effective in 1990. In other states, the bulk of the legislation went into effect in 1992 and 1993.

Many states enacted stiff penalties for employees found guilty of filing fraudulent claims, which may have discouraged workers from filing claims. Other reforms made it harder for filed claims to be accepted. Several states granted employers the privilege of selecting which doctor treats a workplace injury. Since doctors serve as gatekeepers to the WC system, this reform enables employers to choose physicians who are expected to be more conservative about what they consider a valid workplace injury. Other reforms limited a doctor's ability to designate an injury as work-related. Some states began to require that injured workers and their doctors provide objective medical evidence to

[16] Although this is an important change to WC, it is unclear how deregulating premiums would impact the probability a worker receives WC cash benefits or how long the worker remains out of work. Therefore, I do not consider deregulating premiums in this dissertation.

prove the existence of a workplace injury, making it more difficult for injured workers to receive WC for injuries such as back pain and carpal tunnel syndrome. Several states also made it harder for workers to be awarded compensation if the workplace injury aggravates a pre-existing condition, a reform that will especially impact older workers who are more likely to suffer from other conditions (Burton and Spieler, 2001). In Chapter 2, I examine the impact of the increased prevalence of self-insurance and these policy reforms on the WC incidence rate.

Other reforms sought to reduce costs by impacting a claim's duration, or the amount of time between when a worker leaves work because of his or her injury and when the worker has healed and returns to the job. In Chapter 3, I examine one such reform enacted by the state of Ohio, one of five states in which employers must purchase WC insurance from the state (or self-insure). In response to rising employer costs, the state contracted out WC case management responsibilities to companies called Third-Party Case Managers (TCMs) with the hope that, as private companies, TCMs might be able to get injured workers back on the job more efficiently than if the state continued to manage WC claims.[17]

1.3 Literature

There are two main strands to the WC literature; one examines the extensive margin, the receipt of WC benefits, and the other examines the intensive margin, how long a worker receives benefits. When benefits become more generous, injured workers are more likely

[17] In Ohio and the larger WC community, TCMs are referred to as Managed Care Organizations (MCOs); however, I refer to them as TCMs to avoid confusion with health insurance MCOs, which are structured differently.

to claim cash benefits (Bronchetti, 2007; Hirsch et al. 1997; Krueger, 1990; Neuhauser and Raphael, 2004; Ruser et al., 2004; and Ruser, 1985) and receive those benefits longer (Butler and Worrall, 1985; Krueger, 1991; Meyer et al., 1995; and Neuhauser and Raphael, 2004). Although the magnitude of the elasticity is sensitive to the dataset used as well as to the specification, it is always positive, providing evidence that workers do respond to the incentives built into the WC system.

1.3.1 Incidence of Workers' Compensation Receipt

Papers examining the incidence of WC receipt focus on the relationship between WC benefit levels and claiming. When benefits are more generous, workers may be more willing to take risks at the workplace, a moral hazard problem. Even in the absence of moral hazard, more generous benefits might increase WC receipt because workers may be more likely to file for WC, this response is called the reporting effect. Several papers use Current Population Survey (CPS) data to address the relationship between benefit levels and claiming WC cash benefits.

Krueger (1990) was the first to use individual level data to analyze the impact of increased benefit generosity on the WC incidence rate using CPS data. He estimates an elasticity with respect to benefits of .74 when controlling for worker characteristics, state, year, industry, and occupation. That is, a ten percent increase in benefits leads to a 7.4 percent increase in the incidence rate. This result is higher than previous results from aggregate data and higher than many subsequent results using individual level data.

Hirsch, Macpherson, and DuMond (1997) update Krueger's work to include union membership. Union members may be more responsive to WC benefit levels than

non-union workers if unions make workers more aware of WC filing procedures and offer workplace protections to employees who file claims. Since union members are also paid higher wages (and awarded higher benefits) than non-union members, omitting a control for union membership will impose an upward bias on the coefficient describing the impact of benefits on WC receipt. Similar to Krueger (1990), the authors find a positive and significant relationship between benefit levels and the WC incidence rate. However, the estimated elasticity is approximately .18, much lower than the .74 estimated by Krueger (1990).[18] Both of these papers rely on data from the 1980s, so in Chapter 2 I provide an estimated elasticity for the 1990s.

Bronchetti (2007) also updates Krueger's work and uses CPS data from 1977 through 2004.[19] She finds an estimated elasticity of benefit receipt of .38, approximately half as large as Krueger (1990). While this suggests that worker responsiveness to benefits declined during the 1990s, she does not separately isolate the 1990s in her work. Therefore, it is difficult to know if the lower elasticity she finds is a result of including the 1990s or, alternatively, arises from a difference in sample creation or her final specification.[20]

The Relationship Between Benefit Generosity and Claiming

Two possible mechanisms describe how higher benefits lead to increased WC receipt. Higher benefits might induce workers to take more risks, and more injuries occur, or, conditional on being injured at work, workers are more likely to claim WC. With the

[18] In a footnote, Hirsch et al. (1997) suggest their results differ from Krueger's because 1983-1985 were unrepresentative years. Hirsch et al. (1997) claim that when they restrict their sample to those years, their results "…closely resemble his." In Chapter 2, I show how sample restriction criteria impact both sets of results.

[19] The first draft of Chapter 2 was written in 2005, concurrent to the work done by Bronchetti (2007).

[20] Bronchetti (2007) acknowledges that even when restricting her attention to the same years as Krueger (1990), she is not able to replicate his results. She suggests the differences may arise because of different methodologies used to match workers across years or different sample selection criteria.

CPS data, it is not possible to distinguish between these two mechanisms because the data simply capture whether an individual receives WC, not whether injuries occur and whether the injured worker pursues a cash benefit claim. However, two datasets contain this level of detail, California claims data and the National Longitudinal Survey of Youth (NLSY). Papers using these datasets find support for reporting effects and statistically significant relationships between benefit levels and incidence.

Unlike most states, which peg the maximum WC benefit to state average weekly earnings, the maximum benefit is set statutorily in California. The maximum benefit may remain stagnant for several years and then experience a large increase, as in California in 1994 and 1995. In 1994, the maximum benefit increased from $336 to $406 per week. Neuhauser and Raphael (2004) exploit variation in the maximum benefit level over time and across workers who are expected to be impacted by the increase (high earners) and those who are not expected to be impacted (low earners) to assess the impact of benefit increases on claiming behavior. The authors use California administrative claims data to examine this issue. By definition, all of the individuals in the administrative claims database suffered a workplace injury, so any changes in the observed incidence of cash benefit receipt result from the reporting effect (since individuals are in the data conditional on suffering a workplace injury). Conditional on receiving medical WC benefits, the authors find a cash benefit elasticity around .5. That is, a ten percent increase in benefits makes injured workers receiving WC medical care five percent more likely to claim cash benefits.

Ruser et al. (2004) use the NLSY-1979 to examine the relationship between benefit generosity and WC claims in the 1990s. With the NLSY, the authors are able to

separately identify being hurt on the job, missing work as a result of a workplace injury, and claiming WC benefits. This allows the authors to address why benefit generosity matters, and the authors find no evidence of a relationship between benefit generosity and injury rates, casting doubt on the moral hazard explanation. In contrast, they cite strong evidence in support of reporting effects. Conditional on suffering a workplace injury, a ten percent increase in benefit levels increases the claim rate by 5.8 percent.

These papers offer insight into the moral hazard and reporting effects explanations. However, because each paper examines changes to the claim rate, conditional on injury, it is difficult to directly compare the estimated elasticities to those of Hirsch et al. (1997) and Krueger. Therefore, to provide a direct comparison, in Chapter 2 I update Krueger (1990) using data from the 1990s.

Evidence Concerning Policy Changes from the 1990s

When considering worker responsiveness to benefit levels in the 1990s, it is important to account for the changes to the WC system. The changes expected to have an impact on claim incidence include the increased prevalence of self-insurance and the policy reforms that make it harder for a claim to be accepted. In Chapter 2, I account for both of these changes to state WC systems. Although no other paper considers the importance of self-insurance, two papers examine the impact of some other WC policy reforms. Using their subsample of approximately 3,000 injured workers in the NLSY, Ruser et al. (2004) also control for the policy changes that occurred in WC in the 1990s. The authors focus on three types of policy changes: anti-fraud measures, policies that made it harder for claims to be awarded benefits—by either requiring objective medical evidence or limiting claims for injuries that aggravate a pre-existing medical condition, and reforms that gave

employers the right to choose the treating doctor. However, they find no impact of the various policy changes on injury rates or claiming behavior. This could arise because many of the reforms were expected to have the biggest impact on older workers, and the oldest in their sample was only 44.[21]

Boden and Ruser (2003) depart from the recent incidence literature by using aggregate data to estimate the determinants of workplace injuries rather than using individual data to examine WC claims. The authors estimate the frequency of workplace injuries resulting in days away from work as a function of three types of policy changes: granting employers the choice of treating doctor, demanding objective medical evidence, and making it difficult to award compensation if the injury merely aggravates a pre-existing condition. In states that began to require objective medical evidence to support claims, they find that the frequency of workplace injuries fell. However, the authors find no effect of two of the policy reforms—granting physician choice to the employer or making it difficult to be awarded compensation if the injury merely aggravates a pre-existing condition. These results may indicate workplace injuries are not responsive to these policy reforms, or they may reflect the importance of controlling for the individual characteristics that impact a worker's decision to take risks on the job or claim WC (e.g., gender, marital status, age).

Results from Ruser et al. (2004) and Neuhauser and Raphael (2004) suggest worker responsiveness to benefit levels was lower in the 1990s than in the 1980s, but their estimates only consider the reporting effect because WC claim incidence is defined conditional on a workplace injury occurring. In Chapter 2, I estimate a directly comparable elasticity of benefit receipt by directly updating Krueger (1990) for the

[21] By definition, their sample fell between the ages of 14 and 22 in 1979.

1990s. Using these data, I identify a critical sample restriction that is responsible for much of the difference in the Krueger (1990) and Hirsch et al. (1997) results. I provide the first estimates concerning the impact of self-insurance on claim incidence and use a dataset better suited to estimating the impacts of the WC policy reforms in the 1990s. The sample size in the CPS is larger than the NLSY, includes older workers who are more likely to be impacted by the policies, and contains rich demographic characteristics that are related to the likelihood an individual files a claim. These individual characteristics are not available in the aggregate industry-level data used by Boden and Ruser (2003).

1.3.2 Duration of Workers' Compensation Benefits

A second strand of the WC literature considers claim duration, or the length of time a worker receives benefits. The expected impact of more generous benefit levels on the length of time away from work (and receiving WC benefits) is ambiguous. More generous benefits are expected to make injured workers continue to receive benefits for a longer period of time whereas evidence from the incidence literature suggests that more generous benefits encourage workers with less severe injuries to claim cash benefits. Adding these minor claims to the pool of cash benefit recipients might drive down the average length of time away from work. Most of the papers examining the relationship between the duration of WC benefits and benefit levels examine a single state and exploit a similar natural experiment—an increase in the maximum benefit—as in Neuhauser and Raphael (2004). The studies exploit variation over time in the benefit schedule and across workers of different earnings levels—comparing changes in duration for higher

earning workers impacted by the increase of the maximum with changes in duration for lower earning workers not impacted by the increase.

Neuhauser and Raphael (2004) use claims data from the state of California to examine how the duration of benefit receipt responds to changes in the benefit schedule that occurred in the 1990s, taking sample composition changes into account. After correcting for sample composition changes, the authors find an estimated elasticity of duration with respect to benefits of .8. Thus, the higher the benefit levels, the more time a claimant misses from work. Failing to correct for these sample composition changes generates an estimated elasticity of .3. An elasticity of .3 is much closer to the estimated duration elasticities found by Meyer et al. (1995) who use administrative claims data from Kentucky and Michigan to examine increases in maximum benefits that occurred in the early 1980s. Using administrative claims data from Minnesota, Krueger (1991) also examines the impact of an increase in the maximum benefit level. He finds that WC recipients are highly elastic; a ten percent increase in benefits leads to between a three and 17 percent increase in claim duration.[22]

Evidence Concerning Policy Changes from the 1990s

The duration literature largely examines worker responsiveness to benefit levels. Once a worker begins to receive cash benefits, it is plausible to assume that the other parties to the claim—the employer, insurer, and doctor—also influence duration. Krueger (1991) also addresses important WC policy questions by considering the impact of self-insurance on responsiveness to WC benefits. Self-insured employers bear the full cost of each claim, so Krueger hypothesizes that self-insured employers may be more likely to

[22] When Krueger does not take the nonlinearities in the WC benefit schedule into account, the elasticity is .279. When accounting for the nonlinearities, it is 1.67. Neither Neuhauser and Raphael (2004) nor Meyer et al. (1997) account for the nonlinearities in the benefit schedule.

speed return-to-work by offering modified work or more closely monitoring a worker's recovery. Krueger shows that duration is shorter for employees whose employer is self-insured than for those whose employer is privately or publicly insured. If self-insured employers successfully get injured workers back to their jobs quickly, then perhaps self-insured employers also impact claim incidence, a question I address in Chapter 2. Krueger's finding lends support to examining the impact of self-insurance on claim incidence, as in Chapter 2. This result also illustrates that, with the right incentives, case management might impact WC claims, an assertion I examine in Chapter 3.

Using detailed claims information from the Workers' Compensation Research Institute, Neumark et al. (2005) study how allowing the employer to choose the physician impacts the amount of time workers remain away from work. The data represent claims from four states, Texas, Massachusetts, Pennsylvania, and California, and the authors find that workers miss 23 to 32 percent more time when the employee, not the employer, selects the treating physician. The authors show that employees who choose new physicians drive this result.

In Chapter 3, I complement this strand of the duration literature by examining the impact of changing incentives to third-party case managers, as well as show the importance of considering the details of a policy reform and a state's WC system. With the rise in self-insurance and growth in contracting out for public programs, private case managers for WC proliferated. In Chapter 3, I examine the impact of such case managers on WC claim duration and show that duration is responsive to case management—implying a case manager is another important actor in a WC claim. It would be impossible to identify or interpret the effect of these case managers without fully

understanding the state's WC program and the nuances of the policy reform. Chapter 3 shows how valuable it can be to delve into the details in a particular state to uncover the effects of the WC policy reforms.

1.4 Conclusion

In Chapter 2, I examine the question of incidence and update the estimated elasticity of benefit receipt. I show that worker responsiveness to benefit levels fell, even when using the same methodology as Krueger (1990) and controlling for changes to WC in the 1990s. I also am able to attribute the differences in the Krueger (1990) and Hirsch et al. (1997) elasticities to different sample restriction criteria. Consistent with the previous literature, I find no effect of the policy reforms characterized by Boden and Ruser (2003) and Ruser et al. (2004). However, I do conclude that increased prevalence of self-insurance impacted WC incidence.

In Chapter 3, I complement the duration literature and show how important case managers are to the length of a claim. The analysis illustrates the importance of fully understanding WC in a particular state, which classifying reforms in a few categories obscures. More generally, Chapter 3 provides additional evidence concerning the importance of structuring incentives and cautions public entities to consider strategic behavior when crafting such programs.

Tables for Chapter 1

Table 1-1: Fraction of Workers with Earnings Exceeding the Maximum Benefit and State Average Replacement Rate, 2001

State	2001 Maximum	Fraction of Workers Whose Expected Weekly Benefit is the Maximum	Average Replacement Rate
Panel A: States with Lowest Workers' Compensation Maximum Weekly Benefit			
Mississippi	316.46	.50	.54
Arizona	374.10	.27	.58
Georgia	375	.54	.52
Louisiana	388	.40	.58
New York	400	.46	.54
Kansas	401	.47	.55
Arkansas	410	.36	.60
Montana	439	.29	.60
Idaho	445.50	.11	.74
South Dakota	448	.33	.66
Panel B: States with Highest Workers' Compensation Maximum Weekly Benefit			
Pennsylvania	644	.23	.69
Maryland	652	.22	.62
Minnesota	750	.21	.64
Vermont	760	.06	.70
Indiana	762	.13	.65
Massachusetts	830.89	.04	.63
Washington	830.90	.16	.62
New Hampshire	923	.12	.62
District of Columbia	948.76	.20	.79
Illinois	956.32	.12	.75

Source: *Analysis of Workers' Compensation Laws* and author's calculations from Current Population Survey.

Table 1-2: Injury Rates and Workforce Composition for 1-digit Industries, 1989, 1992, and 2001

	Injury Incidence Rate		Share of Workforce in Industry	
	1992	2001	1989	2001
Mining	.073	.040	.010	.009
Construction	.131	.079	.066	.069
Manufacturing	.125	.081	.259	.195
Wholesale	.076	.053	.050	.051
Retail	.087	.057	.182	.178
FIRE	.029	.018	.087	.083
Services	.071	.046	.269	.340

Source: Injury rates for 1992: www.bls.gov/news.release/history/osh_121593.txt viewed 4/12/08; Injury rates for 2001: http://www.bls.gov/iif/oshwc/osh/os/ostb1129.pdf, viewed 4/12/08; Industry composition: author's calculations from CPS data

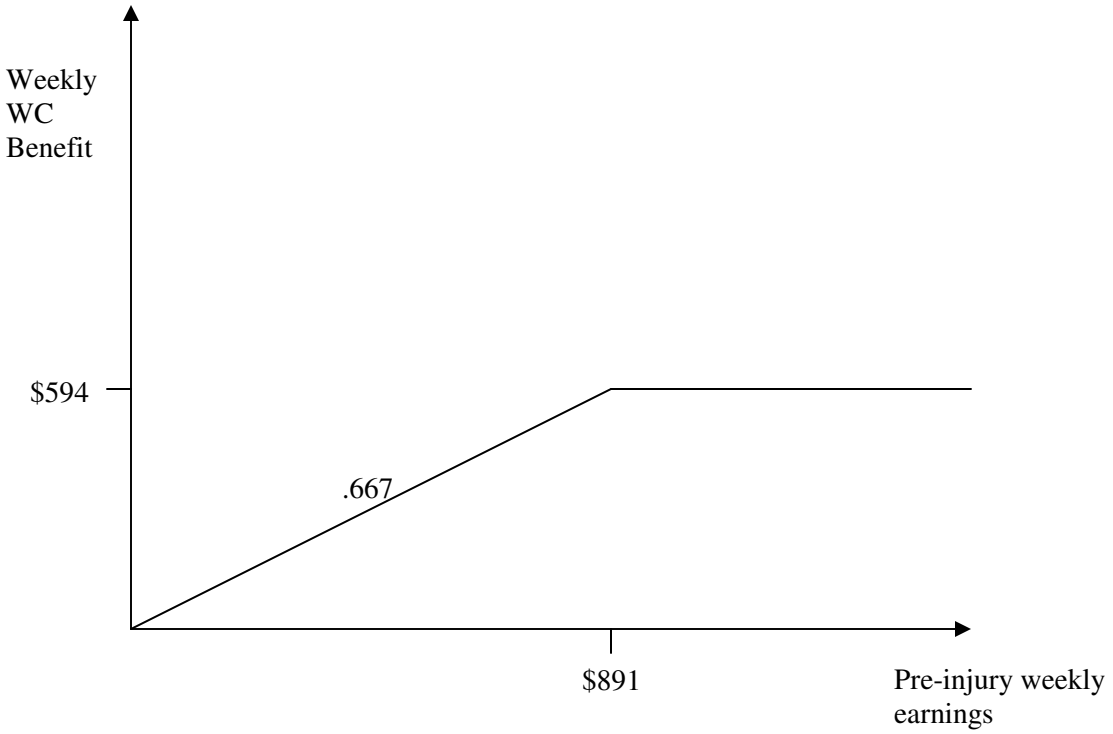
Table 1-3: Effective Dates of Workers' Compensation Policy Changes

State	Reduce Fraud	Employer Selects Doctor	Rule Out Injuries that Aggravate Pre-Existing Conditions	Require Objective Medical Evidence
Alabama	1992			
Alaska	1992			
Arkansas	1993		1993	
Arizona	1994			
California	1993			1993
Connecticut	1992	1993		
Florida			1994	
Georgia	1994			
Kansas			1993	
Kentucky	1994	1995	1996	1996
Maine		1993		
Massachusetts		1992		
Michigan	1992			
Minnesota	1992	1993		1995
Missouri	1992		1993	
Montana	1993	1993		1995
Nebraska	1993			
Nevada		1994	1995	
New York	1996	1997		
North Carolina	1992			
North Dakota	1995			1995
Ohio	1993	1997		
Oklahoma	1992	1995		
Oregon		1990	1990	1990
Rhode Island	1992			
South Carolina	1994			
South Dakota			1995	
Tennessee	1996			
Virginia	1993			
Wyoming			1994	

Source: Boden and Ruser (2003) and Ruser et al. (2004)

Figures for Chapter 1

Figure 1-1: Schedule of Workers' Compensation Cash Benefits (Temporary Total Disability), Colorado (2001)



Source: Analysis of Workers' Compensation Laws. U.S. Chamber of Commerce.

Figure 1-2: A Workers' Compensation Claim

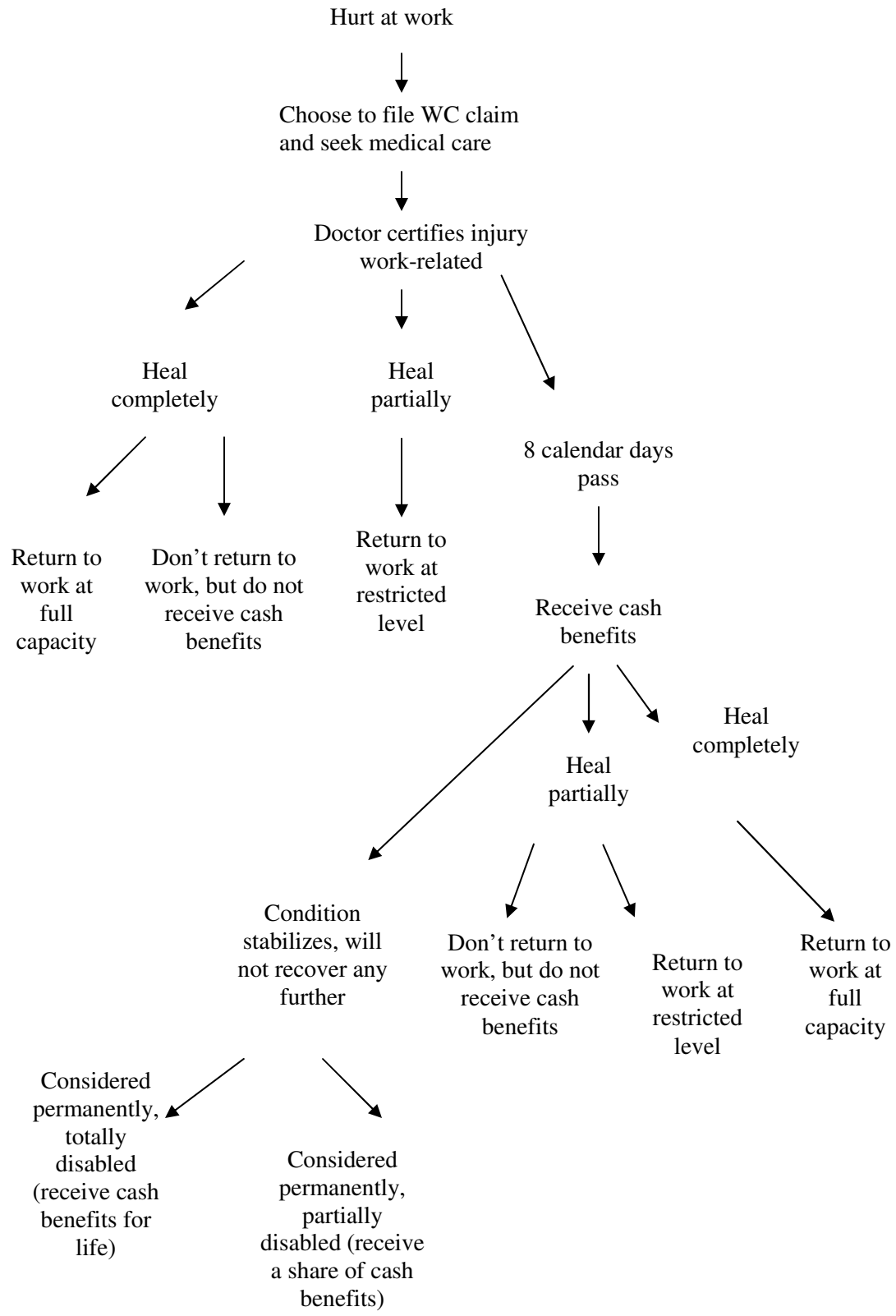


Figure 1-3: Incidence Rate of Workers' Compensation Cash Benefits

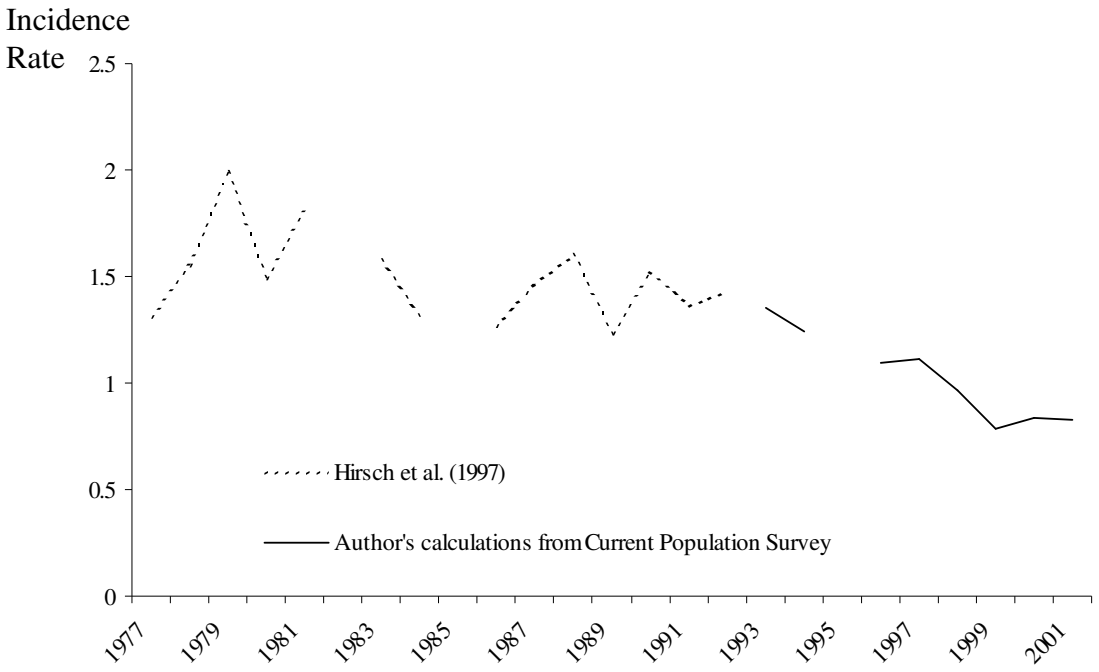
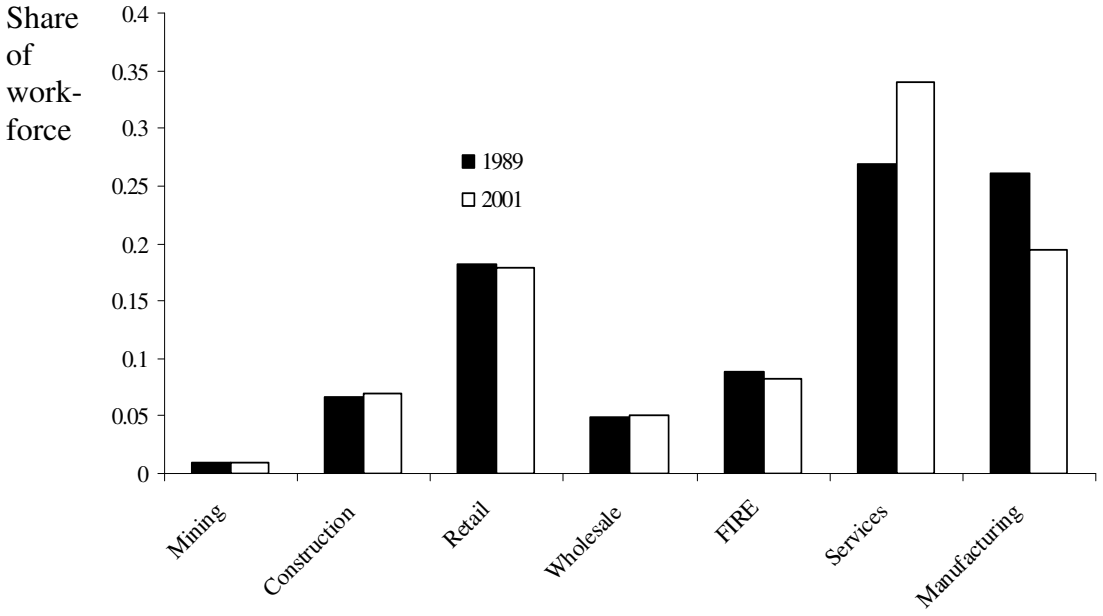
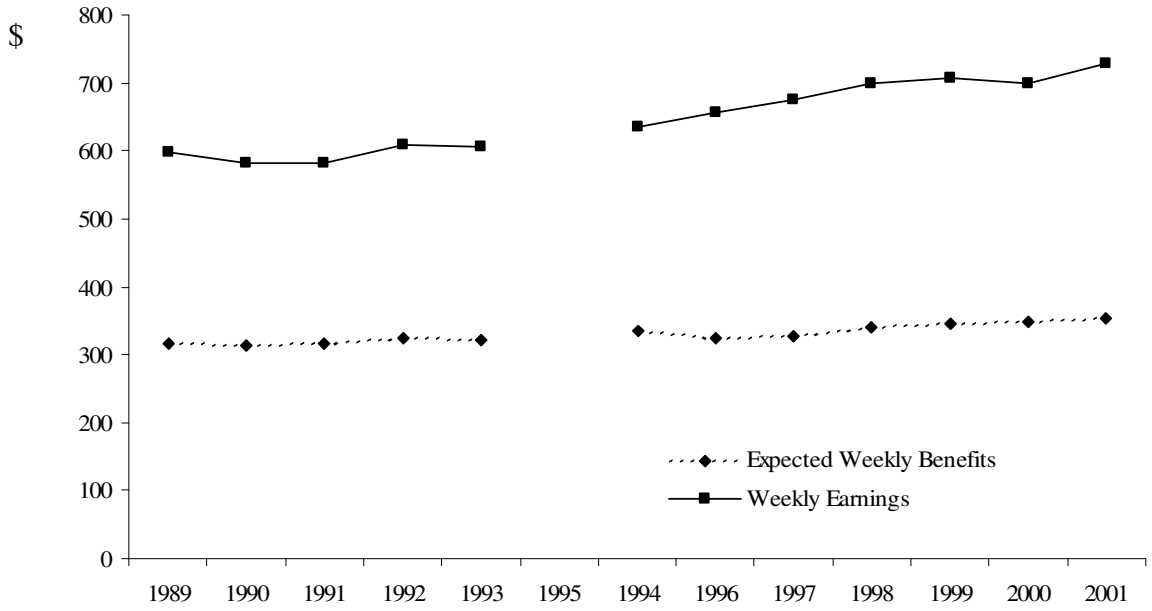


Figure 1-4: Industry Composition, 1989 and 2001



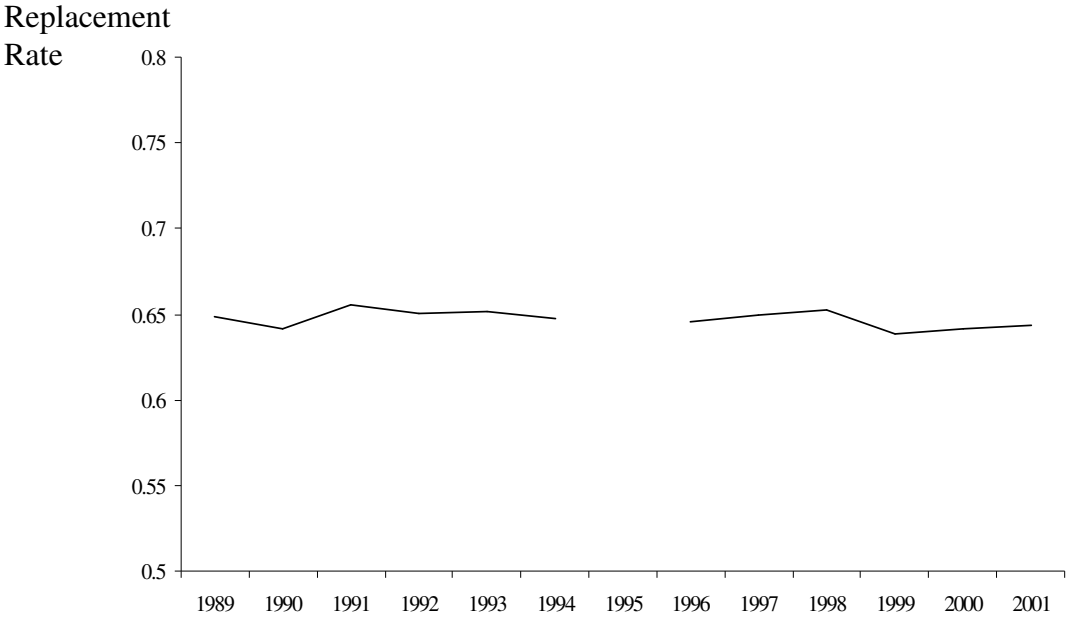
Source: Author's calculations from Current Population Survey

Figure 1-5: Expected Weekly Benefits and Weekly Earnings (2000 $)



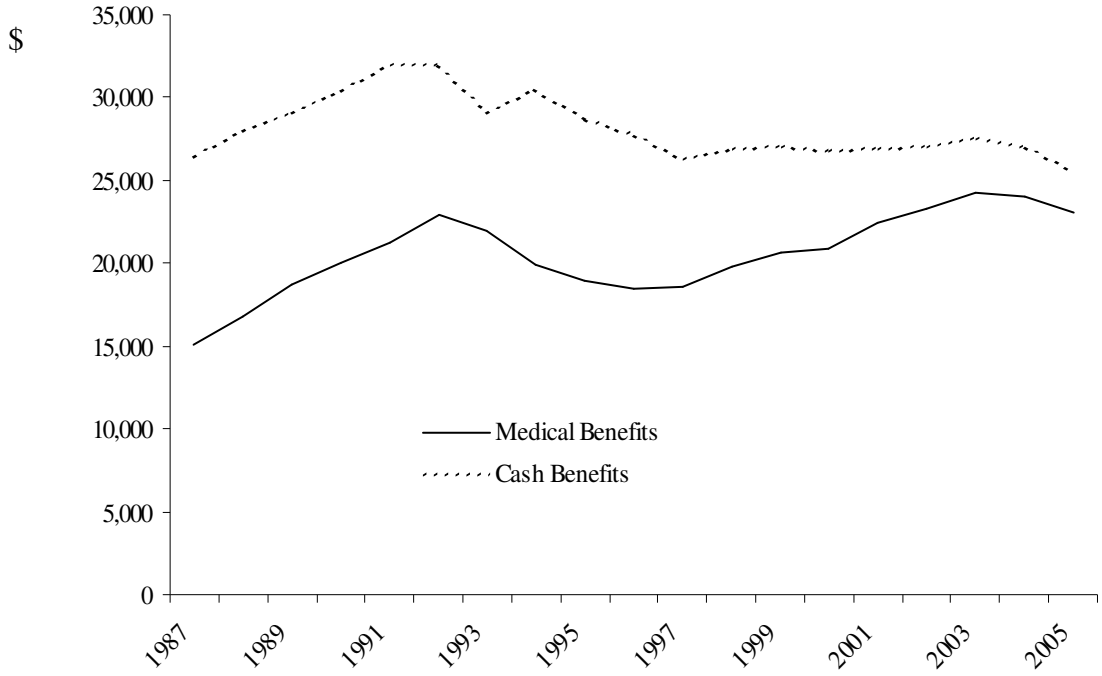
Source: Author's calculations from Current Population Survey; Expected Weekly Benefit parameters acquired from *Analysis of Workers' Compensation Laws.*

Figure 1-6: Replacement Rate (Weekly Benefits/Weekly Earnings)



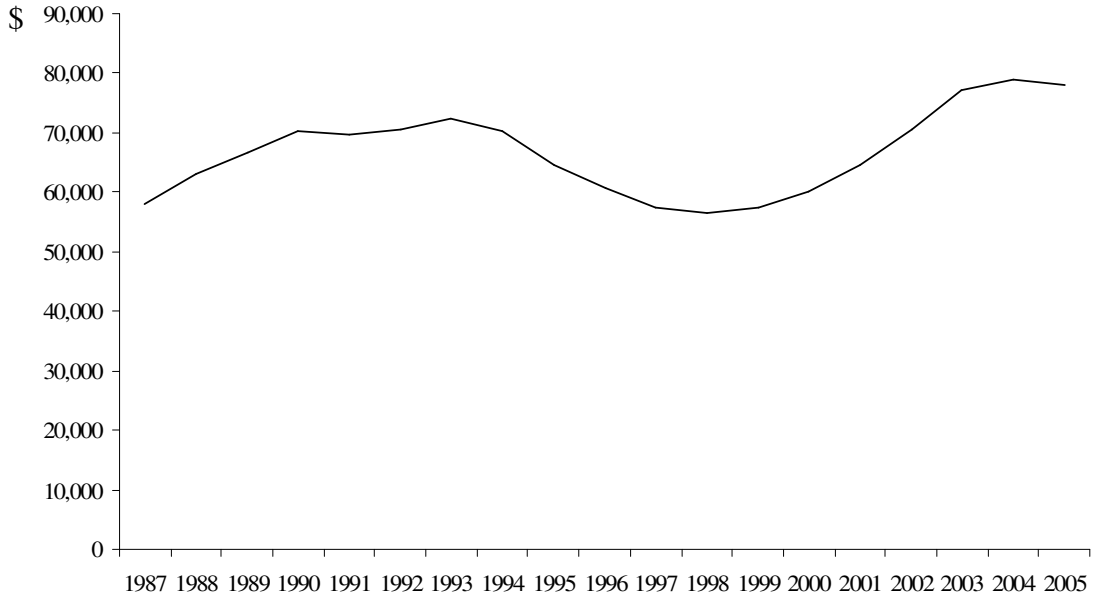
Source: Author's calculations from Current Population Survey.

Figure 1-7: Total Medical and Cash Benefits Paid for Workers' Compensation, 1987-2005, (millions)



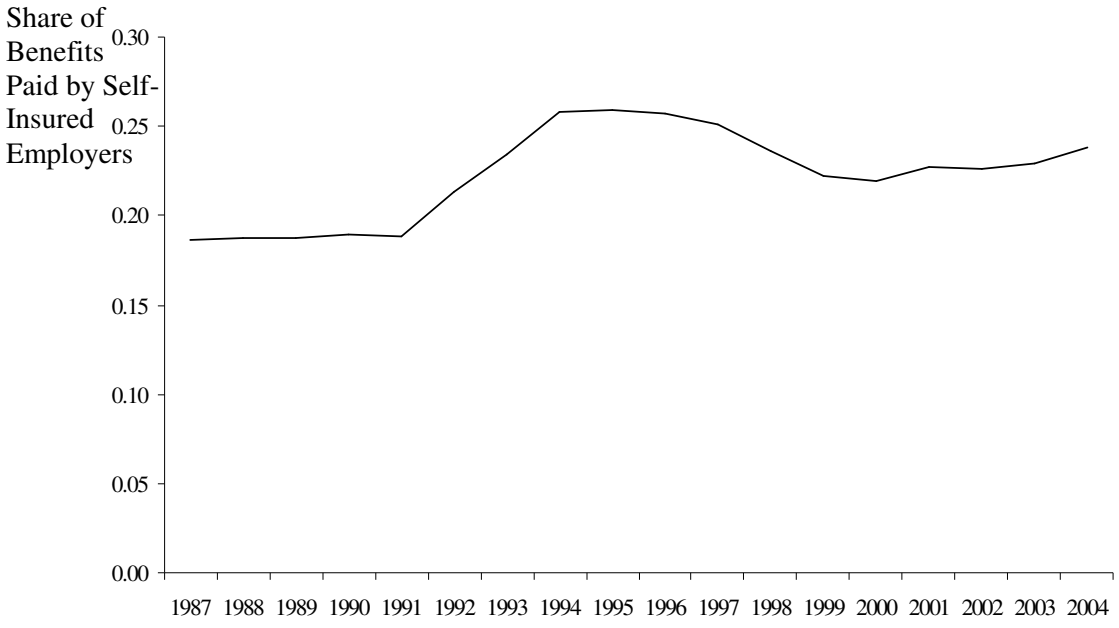
Source: National Academy for Social Insurance (2000 $)

Figure 1-8: Total Employer Costs for Workers' Compensation, 1987-2005 (millions)



Source: National Academy for Social Insurance (2000 $)

Figure 1-9: Share of Workers' Compensation Benefits Paid by Self-Insuring Employers, 1987-2004



Source: National Academy for Social Insurance, 2005

Chapter 2: The Effect of Workers' Compensation Cash Benefit Levels on Claim Incidence in the 1990s

2.1 Introduction

During the 1990s, the incidence rate of Workers' Compensation (WC) insurance claims fell. In 1989, 1.4 percent of workers filed new claims, but in 2001 only .8 percent of workers filed new claims. This decline could have arisen for any of the following three reasons: fewer injuries occurred, fewer injured workers received WC as compensation for a workplace injury, or there was a change in worker responsiveness to benefit levels. Workplaces did become safer in the 1990s as injury rates dropped in all industries and workers moved to safer industries and occupations. There were also nontrivial shifts in the WC system that made it harder for workplace injuries to result in WC benefits. During the 1990s, many states enacted reforms that made it harder for an injured worker to be awarded WC benefits, and there was an increase in the share of benefits covered by self-insured employers.

There is suggestive evidence showing a decline in worker responsiveness to benefit levels (Ruser et al. (2004) and Neuhauser and Raphael (2004)). However, these estimates for the 1990s are not directly comparable to the widely cited estimated elasticities for the 1980s (Krueger (1990) and Hirsch et al. (1997)), so it is unclear if worker responsiveness changed or the results differ because of different methodologies. The Ruser et al. (2004) and Neuhauser and Raphael (2004) estimates for the 1990s

examine WC cash benefit incidence conditional on a workplace injury occurring whereas Krueger (1990) and Hirsch et al. (1997) do not make that same restriction.

In this chapter, I provide results that are directly comparable to those from the 1980s. I control for shifts in the composition of the workforce and improvements in workplace safety. I also control for the different changes to WC systems that impacted the likelihood a claim would be accepted—the different policy reforms and the increased prevalence of self-insurance. It is important to control for these changes to WC to obtain an unbiased estimate of the relationship between claim incidence and benefit levels. Furthermore, estimates of the impact of the changes to WC on claiming behavior are interesting in their own right, and I present the first estimates of the role of self-insurance on benefit claiming.

The estimated elasticity of WC benefit receipt is lower than that found by Krueger (1990) for the 1980s, and is consistent with the other estimates for the 1990s. I find higher rates of self-insurance are negatively correlated with WC receipt, but the other changes to WC in the 1990s had no impact on claims. Finally, I reconcile why the estimated elasticities for the 1980s presented by Krueger (1990) and Hirsch et al. (1997) differ.

2.2 Relationship Between Benefit Levels and WC Claiming

Higher benefit levels may lead to higher WC claim rates in two possible ways. First, as Krueger (1990) develops, when benefits are higher, workers may take more risks. Under the assumption that it is costly to take safety precautions at work, the higher the WC benefits, the fewer precautions the worker will take. In this case, moral hazard leads to

an increase in injuries, medical only claims, and cash benefit claims. Furthermore, the WC cash benefit incidence rate might rise in response to an increase in benefits even if the injury rate does not change because of a "reporting effect."[23] Workers with less severe injuries who otherwise would return to work before one week—the amount of time a worker must miss to claim cash benefits—may instead remain out of work long enough to claim cash benefits if benefit levels are higher. In this chapter, I examine the incidence of cash benefit receipt.

The previously published estimated elasticities from the 1990s (Ruser et al. (2004), Neuhauser and Raphael (2004)) are not directly comparable with those from the 1980s (Krueger (1990), Hirsch et al. (1997)) because the estimates for the 1990s only examine the reporting effect whereas those from the 1980s consider both moral hazard and reporting effects. In this chapter, I directly update the estimates from the 1980s which quantify increases in WC claiming that result from either an increase in injuries or reporting.

2.3 Workplace Injuries and WC in the 1990s

In all likelihood, increased workplace safety contributed to the decline in the incidence rate because during the 1990s, workplaces became safer. Table 1-2 contains the injury rates for each industry in 1992 and 2001, and the injury rate fell in every industry. For example, in 1992 there were 12.5 injuries per 100 manufacturing workers whereas in 2001 there were only 8.1 injuries per 100 workers.[24] Moreover, during the 1990s the composition of the workforce shifted to safer industries. Columns (3) and (4) contain the

[23] For theoretical development of this assertion, see Krueger (1990) and Ruser et al. (2004).
[24] 1992 was the earliest year of data available.

share of the workforce in each industry in 1989 and 2001, respectively. The biggest shifts in employment are away from manufacturing, one of the most dangerous industries, and toward services, one of the safest industries. In addition to these improvements in workplace safety, other changes to WC in the 1990s might also have played a role in reducing the WC incidence rate.

As discussed in Chapter 1, two-thirds of all states enacted some type of reform to their WC systems in the 1990s. Some of these reforms were expected to impact the incidence of WC receipt whereas others attempted to reduce the amount of time injured workers miss from their jobs. In this chapter, I focus on the extensive margin and the changes to WC that were expected to reduce the incidence of WC receipt. Boden and Ruser (2003) and Ruser et al. (2004) characterize the policy reforms using four categories, as shown in Table 1-3.

First, many states enacted stiff penalties for employees found guilty of filing a fraudulent claim. Other reforms made it harder for filed claims to be accepted. Several states granted employers the privilege of selecting which doctor treats a workplace injury or limited a doctor's ability to designate an injury as work-related. Since doctors serve as gatekeepers to the WC system, employers will likely choose physicians who are expected to be more conservative about what they consider a valid workplace injury. Some states began to require that injured workers and their doctors provide objective medical evidence to prove the existence of a workplace injury, making it more difficult for injured workers to receive WC for common, soft-tissue injuries such as back pain and carpal tunnel syndrome. Several states also made it harder for workers to be awarded compensation if the workplace injury aggravated a pre-existing condition, and this

especially impacted older workers who are more likely to suffer from other conditions (Burton and Spieler, 2001).

Oregon was the first state to pass major WC reforms. The legislative changes were effective in 1990 and gave Oregon employers the right to choose the treating doctor, required injured workers and their doctors to provide objective medical evidence, and made it much harder for workers to get compensation for injuries that merely aggravated a pre-existing condition. The bulk of the legislation went into effect in 1992 and 1993, and the two most common reforms were implementing anti-fraud measures and granting employers the right to select which doctor will treat the injury.

Another response to rising WC employer costs was the shift towards self-insurance. As shown in Figure 1-9, between 1987 and 1995, the share of benefits covered by self-insurance increased by 40 percent. If an employer self-insures for WC, the employer bears all of the risk of a given claim, so employers that self-insure are expected to expend more effort getting injured workers back on the job. In his theoretical development, Krueger (1990) shows an employer's incentive to invest in workplace safety or discourage WC claims rises with an employer's level of experience rating, and self-insured employers are perfectly experience rated. Therefore, as more employers turned to self-insurance in the 1990s, more employers had an incentive to discourage claims completely or prevent medical-only claims from progressing to cash benefit claims. When estimating the relationship between benefit levels and WC receipt, it will be important to control for these improvements in workplace safety and changes to the WC system. My estimates will also provide insight into the impact of these changes on WC claim incidence.

2.4 Literature

Krueger (1990) was the first to use individual level data to analyze the impact of increased benefit generosity on the WC incidence rate. Using Current Population Survey (CPS) data matched for 1983/1984 and 1984/1985, the estimated elasticity of incidence with respect to benefits is .74 when controlling for worker characteristics, state, year, industry, and occupation. That is, a ten percent increase in benefits leads to a 7.4 percent increase in the incidence rate. This result is higher than previous results from aggregate data and other results from individual level data.[25]

Hirsch, Macpherson, and DuMond (1997) update Krueger's work to include union membership and use additional years of the CPS from 1977 through 1992. Union members may be more responsive to WC benefit levels than non-union workers if unions make workers more aware of WC filing procedures and offer workplace protections to employees who file claims. Since union members are also paid higher wages (and awarded higher benefits) than non-union members, omitting a control for union membership will impose an upward bias on the coefficient describing the impact of benefits on WC receipt. Similar to Krueger (1990), the authors find a positive and significant relationship between benefit levels and the WC incidence rate. However, the estimated elasticity is approximately .18, much lower than the .74 estimated by Krueger (1990).

[25] Estimated elasticities from aggregate data range from .116 to .708 (e.g., see Bartel and Thomas (1985); Butler and Worrall (1983); Chelius (1982); Chelius and Kavanaugh (1988); and Ruser (1985)) and other estimates from individual data range from .18 and .58 (e.g., see Hirsch et al. (1997); Neuhauser and Raphael (2004); Ruser et al. (2004)).

Hirsch et al. (1997) note that when they use the same years of data as Krueger (1990), the estimated elasticity is much higher than for their full sample, suggesting the discrepancy between the two estimated elasticities is driven by Krueger's small sample of unrepresentative years. While this may be true, another important difference between the two papers could contribute to the different elasticities. Both authors compute the expected WC benefit using each state's parameters, and in most states this is straightforward because an injured worker's WC benefit is equal to 2/3 of his or her pre-injury earnings, subject to a maximum benefit level. In some states, however, benefits are a function of a worker's post-tax earnings, and constructing post-tax earnings requires several assumptions about deductions and exemptions. Excluding states where benefits are a function of post-tax earnings reduces the noise in the benefits variable. Hirsch et al. (1997) include all 50 states in their analysis whereas Krueger (1990) excludes those states in which WC benefits are a function of post-tax earnings.

The main contribution of this chapter is to provide an updated estimated elasticity of benefit receipt. Previously published estimated elasticities for the 1990s are not directly comparable to Krueger (1990) or Hirsch at al. (1997) because they define claim incidence differently. Using the National Longitudinal Survey of Youth—1979, Ruser et al. (2004) find that conditional on suffering a workplace injury, a ten percent increase in benefit levels increases the claim rate by 5.8 percent. Using California administrative claims data, Neuhauser and Raphael (2004) find a benefit claiming elasticity around .5, conditional on receiving medical benefits. That is, a ten percent increase in benefits makes injured workers who receive WC medical care five percent more likely to claim cash benefits. Together, these results suggest worker responsiveness declined, and I will

be able to confirm this assertion by directly replicating Krueger (1990) using data from the 1990s.

2.5 Data and Econometric Approach

2.5.1 Data

To estimate the elasticity of WC receipt with respect to benefit levels, I pooled individual data from successive CPS's for the years 1989 through 2001. Following Krueger (1990) and Hirsch et al. (1997), I match individuals in successive years so that I can identify the incidence of WC receipt.[26] By observing individuals two years in a row, I am able to identify those individuals who did not receive WC in year t-1. Therefore, I identify new cases of WC as transitions to WC in year t. I am able to match individuals in successive years because respondents in the CPS are included for four months, excluded for eight months, and then return to the survey for another four months, making it possible to match many March respondents two years in a row. Over this time period, the CPS does not contain individual identifiers, so to match March respondents from one year to the next, I use household identifiers and confirm that the individual's age, race, and sex are consistent in both periods, following Madrian and Lefgren (1999).[27] The CPS changed the methodology used to construct household identifiers between 1994 and 1995, excluding 1994/1995. The extent of these matching restrictions is shown in Table 2-1,

[26] I use the matching programs available from the National Bureau of Economic Research and described in Madrian and Lefgren (1999).

[27] I only kept individuals whose sex and race matched exactly in t and t-1. I allowed age to vary; I kept individuals with age differences between one and three years. At first glance, this range allowed for age may seem too broad, but two simple examples show it is reasonable. For March birthdays, age could vary as little as 0 years if in year t-1 the survey was administered after their birthday but in year t it was given before their birthday. Age could also vary as much as two years if the survey was administered before the birthday in t but after the birthday in t-1.

and I am able to match over two-thirds of the 843,674 individuals eligible to be matched across years.

The March CPS asks respondents questions about the year preceding the survey, so the matched March 1989/March 1990 CPS contains information about individuals in 1988 and 1989. The sample is comprised of civilian, non-institutionalized individuals ages 18 through 65 who worked at least one week in year t-1, and were employed in the private sector. To identify *new* cases of WC receipt in year t, I also restrict the sample to workers who did not receive any WC benefits in year t-1. I exclude individuals who worked in the agriculture or domestic services industries, sectors which are not likely to be covered by workers compensation, and drop railroad workers, longshoremen, harbor workers, and seamen because they are likely to be covered under the federal programs.

Finally, following Krueger (1990), I exclude individuals who live in states where benefits are computed from after-tax earnings at any point between 1988 and 2002 because accurately describing their after tax weekly wage requires many assumptions about deductions and exemptions. This restriction drops workers from Alaska, the District of Columbia, Iowa, Michigan, Connecticut, Maine, and Rhode Island. The final sample includes 166,686 individuals.

2.5.2 Descriptive Statistics

Table 2-2 contains descriptive statistics about WC receipt and the workers who claim WC. In column (1), I characterize the full sample, and show that 1.1 percent of all eligible workers receive WC. In columns (2) and (3), I present corresponding descriptive statistics for workers who receive WC and those who do not, respectively. Using each

state's parameters for WC receipt, I compute the expected weekly WC benefit for each worker.[28] WC recipients face slightly *lower* expected weekly benefits, $331 per week, whereas those who do not receive benefits face expected benefits of $337 per week. This seems contrary to the result that individuals are more likely to claim WC when benefits are higher; however, those results hold earnings constant.[29] WC recipients earn less than non-recipients; WC recipients earn an average of $562 per week whereas non-recipients earn approximately $661. To characterize benefit generosity relative to earnings, consider the replacement rate—the ratio of benefits to earnings. Though the difference is not statistically significant, the replacement rate for WC recipients is .651, versus .647 for non-recipients. Since WC benefits are not taxed, it is also important to control for a worker's marginal tax rate to capture the effective replacement rate of benefits. For each family, I construct a marginal tax rate on earnings in year t-1 using the internet TAXSIM program provided by the NBER. As expected, WC recipients, who also have lower earnings, have lower marginal tax rates.

Hirsch et al. (1997) demonstrate the importance of considering union membership. Unions may make workers more aware of WC filling procedures and offer workplace protections to employees who file claims. As was true in the 1980s, WC recipients are more likely to be union members. Over six percent of all WC recipients

[28] I use the relevant year's parameters, as captured in the *Analysis of Workers' Compensation Laws*, considering dependents in the household in year t. Parameters were unavailable for 1997, so I linearly interpolated the parameters from 1996 and 1998. I verified the results are robust to excluding all 1997 observations.

[29] This relationship differs from Krueger's analysis where recipients receive higher benefits. This change between the early 1980s and the 1990s likely reflects the increase in income inequality. Workers in the right hand tail of the income distribution claim WC benefits at a much lower rate than workers at lower points in the income distribution. Since income grew more for families at the top of the income distribution, benefits are a function of earnings, and high earners claim WC at much lower rates than workers in the middle of the distribution, it follows that expected WC benefits will be higher for non-recipients. Furthermore, when considering workers whose earnings fall below the 90th percentile, expected benefits for recipients are $322 per week versus $314 per week for non-recipients.

are union members, compared with 2.5 percent of non-recipients. As shown in Figure 2-1, union membership declined slightly during the 1990s.[30] If unions do make WC more accessible, then declining rates of unionization might also have contributed to the falling incidence rate.

In this analysis, I consider two types of changes to WC: the policy reforms of the 1990s and the increase in self-insurance. Over half of all workers live in a state that passed WC reform during the 1990s, and most of these workers are observed in reform states after the policies are in effect. I also consider the changes in the prevalence of self-insurance and find workers live in states where a little over one-fifth of benefits are paid by self-insuring employers, on average.

Some jobs are inherently safer than others, and as shown in Table 2-3, WC recipients are much more likely than non-recipients to work in more dangerous occupations such as craft worker, operator, transportation worker, or laborer. Similarly, WC recipients are much more likely to work in dangerous industries such as manufacturing and construction. The demographic characteristics of WC recipients are consistent with these industry and occupation characteristics. WC recipients have lower levels of education, and a larger share of recipients are male, .59 versus .52 in the full sample.

Next I examine the correlation between the changes to WC that occurred during this time period and WC receipt. In Table 2-4, column (1) contains descriptive statistics for workers in states that passed policy reforms and column (2) contains characteristics of workers in states that did not enact reform. Reform states have less generous benefits,

[30] In results not shown, I find that this decline is present even after controlling for a worker's industry and occupation.

lower rates of union membership, and a higher share of benefits covered by self-insurance. In columns (4) and (5), I compare reform states before and after reforms were in effect. These descriptive statistics provide the first suggestive evidence that the policies impacted incidence. After the passage of the WC reform, the incidence rate fell from .0131 to .0113. The benefit replacement rate fell once the reforms were in place, suggesting the reforms are correlated with benefit generosity. Neglecting to control for these policy reforms is expected to exert an *upward* bias on the coefficient on benefits. In this chapter, I consider three different types of policy reforms: anti-fraud measures, employer choice of doctor, and policies that make it harder to qualify for cash benefits. In column (5) I show that of the workers impacted by one of the reforms, 62 percent faced anti-fraud measures in contrast with 38 percent of workers losing the right to choose their physician and 36 percent impacted by policies that demanded stricter medical criteria.

The trends in self-insurance presented in Figure 1-9 show that, throughout the 1990s, the share of benefits covered by self-insurance rose from 1987 to 1994 and then fell slightly. If self-insuring employers are able to make it harder for workers to claim WC, then when the prevalence of self-insurance rises (falls), the incidence rate is expected to fall (rise). In Table 2-5, I show how WC receipt changed in response to an increase or decrease in the share of benefits covered by self-insurance. The incidence rate is 1.2 in the year before the share covered by self-insurance increases and then falls to 1.0, and this difference in means is statistically significant at the ten percent level. In contrast, there is no significant change in the incidence rate after the share of self-

insurance falls. These descriptive statistics provide suggestive evidence that changes to WC in the 1990s impacted claim incidence.

2.5.3 Methodology

I first directly replicate Krueger (1990) and estimate a probit model of the following form:

$$\Pr(WC_{i,s,t} = 1 \mid G_{i,s,t}, X_{i,s,t}, T_t, S_s) = \Phi(G_{i,s,t}\beta + X_{i,s,t}\theta + T_t\alpha + S_s\lambda) \qquad (1)$$

where *i* references the individual, *s* the state, and *t* the year. Let *G* represent benefit generosity (log benefits, log weekly earnings, and the worker's marginal tax rate), and the coefficient of interest is $\beta_{Ln(Ben)}$, the coefficient on log benefits. The vector *X* contains demographic characteristics about the worker (gender, age, race, marital status, and level of education). I also include industry and occupation effects to control for job safety. The vector *T* contains year effects to capture shifts in claiming behavior between 1989 and 2001 that are common to all workers. Since WC is a state-level program, it varies widely across states and it is difficult to completely capture these differences in the parameters Ln(Benefits), Ln(Earnings), and marginal tax rate. Therefore, in the vector *S* I include state effects to capture any underlying differences across states in the incidence of WC receipt. This specification directly updates Krueger (1990) for the 1990s, and from these coefficient estimates, I construct the estimated elasticity of benefit receipt:

$$\hat{\varepsilon}_{WC,Benefits} = \frac{\hat{\beta}_{Ln(Ben)} * \phi\left(\overline{WC}\right)}{\Phi\left(\overline{WC}\right)} \qquad (2)$$

This parsimonious specification omits union status, controls for policy reforms, and self-insurance—factors which impact WC receipt. Yatchew and Griliches (1985) provide a

framework to predict how omitting these factors will impact the probit estimates. Since union members have higher wages, they have higher expected benefits, and union members also have higher rates of benefit claiming. Therefore, omitting union membership exerts an upward bias on the coefficient estimate for $\beta_{Ln(Ben)}$, and by including union membership the estimated elasticity is expected to fall, as is found in Hirsch et al. (1997). I test this prediction with:

$$\Pr(WC_{i,s,t} = 1 \mid G_{i,s,t}, X_{i,s,t}, T_t, S_s, U_i) = \Phi(G_{i,s,t}\beta + X_{i,s,t}\theta + T_t\alpha + S_s\lambda + U_i\kappa) \qquad (3)$$

where U=1 if the worker belonged to a union in t-1.

The policies that make it harder for an individual to be awarded benefits are also expected to impact the estimated elasticity of WC receipt. I include controls for the three different types of policy reforms, and the share of benefits covered by self-insurance, in the vector P.

$$\begin{aligned}&\Pr(WC_{i,s,t} = 1 \mid G_{i,s,t}, X_{i,s,t}, T_t, S_s, U_i, P_{s,t}) = \\ &\Phi(G_{i,s,t}\beta + X_{i,s,t}\theta + T_t\alpha + S_s\lambda + U_i\kappa + P_{s,t}\sigma)\end{aligned} \qquad (4)$$

Expected benefits and rates of WC receipt are lower in states that have enacted policies, implying that the estimate for $\beta_{Ln(Ben)}$ should fall when the policy controls are included.

2.6 Empirical Results

Column (1) of Table 2-6a contains the results from directly updating Krueger (1990). I present marginal effects with the z-statistic in parentheses.[31] As in Krueger (1990), I find a positive, statistically significant relationship between Ln(Benefits) and WC receipt. Increasing benefits by one percent increases the probability the average worker claims

[31] For continuous variables, marginal effects are taken at the mean value of all variables and for binary variables, marginal effects are the difference between assigning all observations a value of 1 and a value of 0.

WC by .4 percentage points. In contrast, increasing earnings or the marginal tax rate decreases the probability a worker claims WC. Table 2-6b also shows the marginal effects associated with different occupations and industries (laborers are the omitted occupation and manufacturing is the omitted industry). As expected, laborers face a higher probability of WC receipt than managers, professional, sales, clerical, or service workers. In contrast, laborers are less likely to receive WC than craft workers, operators, and transportation workers. Workers in the mining and manufacturing industries are also the most likely to receive WC.

The estimated elasticity of WC receipt is .489. That is, a ten percent increase in benefits corresponds to a 4.9 percent increase in WC incidence. This value is smaller than the .74 elasticity estimated by Krueger (1990). This parsimonious specification is expected to generate an upper bound estimate because including union status and the changes to WC is expected to lower the estimate for $\beta_{Ln(Ben)}$. This decline in the estimated elasticity could arise if there is a true decline in worker responsiveness to benefit levels or there is some shift in responsiveness I am unable to capture with the observed data. This estimate of .49 is close to the previously published estimates of .5 and .58 found by Ruser et al. (2004) and Neuhauser and Raphael (2004).

In column (2), I include a measure of union status. This specification approaches Hirsch et al. (1997) and I also find a positive and statistically significant impact of union membership on WC claiming. As expected, the estimated benefit elasticity falls, but only slightly, from .4887 to .4865. However, this estimated elasticity of .4864 is still much larger than the .18 estimated by Hirsch et al. (1997).

The sample is constructed using the criteria described in Krueger (1990). In columns (1) and (2), I exclude workers who live in a state which computes benefits as a function of post-tax earnings, and the estimated elasticities of approximately .49 are lower than the .74 estimated by Krueger.[32] This suggests worker responsiveness in the 1990s was lower than in the 1980s. As an additional test, I construct a sample that I can directly compare to Hirsch et al. (1997). In columns (3) and (4), I include workers from all states, no matter how benefits are computed, but exclude workers who held more than one job in year t-1.[33] The authors assume workers holding only one job in year t were in the same job the previous year, when information about union membership was reported. In columns (3) and (4) I present estimates of equations (1) and (3) using the sample restrictions in Hirsch et al. (1997) and find estimated elasticities of .09, much lower than their .18 estimate.[34]

In Table 2-6b, I present marginal effects for the remaining demographic characteristics. As is true in the WC literature, conditional on industry and occupation, men have lower rates of WC receipt. Workers with lower levels of education are more likely to receive WC and single workers are less likely to claim.

2.6.1 Policy Reforms

If the policy reforms impacted a worker's propensity to claim WC benefits, and the reforms are correlated with benefit levels, then the estimates in Table 2-6a are biased. Therefore, in Table 2-7 I include controls for the policy changes. I first include an indicator variable that equals one after the policy is in effect and consider each type of

[32] Following Krueger (1990), I also exclude workers younger than age 18.
[33] Following Hirsch et al. (1997), I include workers younger than age 18.
[34] In results not presented here, I ascertain that excluding states that construct benefits as a function of post-tax earnings is the restriction responsible for the vast difference in the Krueger and Hirsch et al. results.

policy separately. None of the policies has a substantively or statistically significant impact on WC receipt and the benefit elasticity changes only slightly across the columns, ranging from .4847 to .4871. The policies may have an additive effect, so in column (5) I include indicators for each policy and again see little change in the estimated elasticity, which is now .4881. Again, none of the policy variables is significant, and they are not jointly significant. If WC claiming declines because passing reforms changes the tone of the state's WC system, then it is important to identify when the first policy change occurred in a state, as in column (6). The indicator "any policy" equals one every year after the first policy is implemented. As in the other specifications, this policy effect is small in magnitude, not statistically significant, and does not change the benefit elasticity much (.4857).

Simply identifying the policies with an indicator variable, as in Table 2-7, does not allow for lagged effects of a policy change nor does it control for any increased rate of claiming in the years leading up to the reform. Therefore, in Table 2-8 I characterize the reforms with a series of indicator variables identifying the two years before the policy is in effect, the year of implementation, and the three plus years after it is in place. Again, I include each type of policy separately in columns (2) through (4) and the complete set of leads and lags in column (5). As in Table 2-7, the marginal effects of the policy variables are small in magnitude, rarely statistically significant, and not jointly significant. Furthermore, the estimated benefit elasticity is largely invariant to the inclusion of these different controls; it now ranges from .4856 to .4954. This result could arise if the policies have no effect on claiming behavior, if the policies are categorized incorrectly, or are included with the wrong functional form.

This result is consistent with the previous literature which has not found an impact of these four categories of policy reforms on WC claims. Ruser et al. (2004) find no impact of policies to reduce fraud and suggest these policies might have little or no impact because they assert "… very few cases of fraudulent worker behavior have been alleged." The second class of reforms I examine, those that make it harder for an injury to qualify for WC, are expected to have the most impact on older workers so it may be difficult to find an effect when considering workers of all ages (Burton and Spieler, 2001). Therefore, in results not presented here I restrict attention to those workers ages 45 and older, and I still find the policies have no effect. The final type of policy reform I study is granting the employer the right to choose the doctor, and as Neumark et al. (2005) show, this is expected to have modest effects. Neumark et al. (2005) find that claims are more expensive and last longer only when workers choose a *new* doctor, and that this happens only rarely. Their sample is restricted to cash benefit recipients and their analysis focuses on the intensive margin—the cost of cash benefit claims and the length of time workers receive benefits. Depending on the timing of when injured workers seek a new doctor, there may not be any expected impact on the extensive margin, whether a worker claims benefits or not.

2.6.2 Self-Insurance

Although I find no evidence in support of the policy changes affecting WC claim incidence, I also consider another change to WC which occurred in the 1990s—the increased prevalence of self-insurance. In the CPS, I cannot observe which workers are employed by self-insuring employers, so I control for self-insurance with the share of benefits paid by self-insuring employers in the worker's state that year. Workers in states

with higher shares of benefits paid by self-insurance have a higher probability of working for a self-insuring employer. If self-insured employers are more successful at lowering the cost of claims, the higher the share of benefits paid by self-insuring employer, the lower the probability a worker will file a WC claim. These data are only available beginning in 1992, so in columns (1) and (2) of Table 2-9, I first reproduce the baseline estimates for the years 1992 through 2001. I find little difference in the marginal effects or the estimated elasticity when I exclude the years 1989 to 1991.

In column (3), I include the share of benefits in a state that are covered by self-insurance. The marginal effect is negative, as expected, (-.010) but it is not statistically significant. In column (4) I include all of the policy variables as well as the share of self-insurance. The marginal effect implies that increasing the share of self-insurance by one percentage point (or 4.4 percent from a base of .228) reduces the probability a worker claims WC by .8 percentage points, or 73 percent. This effect seems implausibly large but is consistent with previous findings for self-insured versus privately insured firms. Among self-insured employers, Krueger (1991) finds a *negative* relationship between benefit levels and the length of claims.

Self-insurance is more prevalent in some industries than others. For example, manufacturing has a high rate of self-insurance, so changes in the share of benefits paid by self-insuring employers are likely driven by manufacturers. In column (5) , I allow the effect of self-insurance to vary by whether or not a worker is in the manufacturing industry. Consistent with expectations, I find a negative and statistically significant impact of the effect of self-insurance on the incidence rate for manufacturing workers, the marginal effect is -.0136. I also find a smaller, also negative, but not statistically

significant impact on the incidence rate for workers in the balance of industries, the marginal effect is -.007. Although these results imply that incidence rates fell when the prevalence of self-insurance rises, the estimated elasticity remains relatively unchanged (.5038).

2.6.3 Accounting for Changes in Injury Rates

The lower estimated elasticity for the 1990s might arise if there was a decline in worker responsiveness, or if the relationship is still be mis-specified. As shown in Table 1-2, there were two important shifts in workplace safety that might also impact the WC incidence rate. During the 1990s, the workforce shifted to safer industries and injury rates fell in every industry. However, the injury rate did not fall uniformly across all industries. By including time-invariant industry effects and industry-invariant year effects, the specification is not flexible enough to capture the differential decline in injury rates across industry. In results not shown here, I add industry-by-year effects and continue to find an estimated elasticity of approximately .5. Thus, the estimate of .5 is robust to being much more flexible about changes in workplace safety.

2.7 Conclusion

The incidence rate for WC fell dramatically in the 1990s. Workplaces became safer because injury rates dropped and the workforce shifted to safer industries and occupations. During the 1990s several changes to the WC system may also have impacted WC claiming. In this chapter, I examine worker responsiveness to benefit levels controlling for these changes in the workplace and state WC programs.

I estimate a much lower elasticity of WC receipt with respect to benefits in the 1990s, approximately .5. I find this estimated elasticity is robust to including controls for WC policy reforms, the prevalence of self-insurance, and declining injury rates by industry. Consistent with previously published estimates for the 1990s, this suggests a decline in worker responsiveness to benefit levels in the 1990s (Neuhauser and Raphael (2004), and Ruser et al. (2004)). In future work, I will include additional years of data, back to 1977, encompassing the time covered by both Krueger (1990) and Hirsch et al. (1997). Using the expanded data, I will replicate their results and verify that the differences in elasticity are due to the changes in the 1990s and not my estimation approach.

I also produced estimates of the effect of the policy reforms and increased prevalence of self-insurance on WC claims. Estimated impacts for the policy reforms are small in magnitude and not statistically significant. This result might arise if the policies truly have no impact on claiming or if characterizing reforms in this way obscures important nuances in a state's WC system. In Chapter 3, I analyze the impact of a policy reform that occurred in the state of Ohio in the mid-1990s. By focusing on one state, I am able to identify the different incentives inherent in the policy change. The coefficient estimate on the share of benefits covered by self-insurance is negative and implies that workplace climate, not statewide policies, have the most bearing on an individual's decision to claim WC. In Chapter 3, I examine a policy change intended to motivate employers and case managers to keep WC costs down.

Tables for Chapter 2

Table 2-1: Sample Construction

Individuals in March CPS, 1989-2001	1,711,981
Observed in year t-1	843,674
Merged with subsequent year	549,826
Ages 18-64	332,039
Individual is a civilian and does not live in group quarters	331,216
Worked at least one week in year t-1	267,734
Employed in private sector	198,390
Wage was at least $2.00 per hour	195,067
Did not receive WC in year t-1	192,249
Exclude railroad, domestic, agricultural, and longshore workers as well as workers employed in farm, forestry, and fishing occupations	185,948
Drop observations whose WC benefits are based on a percent of post-tax earnings	166,686

Table 2-2: Descriptive Statistics, Workers' Compensation (WC) Claiming and Policy Variables

	Full Sample (1)	WC Recipients (2)	Workers who do not receive WC (3)	T-stat Col (2)= Col (3) (4)
WC receipt	.011	1	0	
Benefits	336.68 (159.98)	330.67 (142.54)	336.75 (160.17)	1.66
Wages	660.12 (792.66)	562.54 (373.70)	661.23 (796.09)	5.36
Replacement rate	.65	.65	.65	.69
Maximum benefit in state of residence	516.81 (128.25)	508.13 (122.16)	516.91 (128.32)	2.95
Marginal tax rate	.25	.23	.25	6.73
Union membership	.026	.062	.025	9.87
Live in state that enacted WC reform	.568	.579	.568	1.05
Impacted by WC reform	.513	.516	.513	.27
Share of benefits covered by self-insurance (92-01)	.228	.232	.228	1.65
N	166,686	1,876	164,810	

Table 2-3: Descriptive Statistics, Characteristics of Workers' Compensation (WC) Recipients

	Full Sample (1)	WC Recipients (2)	Workers who do not receive WC (3)	T-stat Col (2)= Col (3) (4)
Age	39.40 (11.85)	40.09 (11.27)	39.40 (11.86)	2.54
Male	.52	.59	.52	5.82
High school degree	.37	.49	.37	10.33
Some college	.28	.25	.28	2.91
College or more	.23	.09	.28	15.43
Black	.08	.09	.08	.99
Hispanic, Other	.11	.12	.11	.47
Single[4]	.22	.18	.22	3.94
Occupation:				
Manager	.15	.06	.15	10.54
Professional	.15	.08	.15	9.27
Sales	.14	.09	.14	6.26
Clerical	.16	.11	.16	5.81
Service	.11	.12	.11	1.38
Craft	.13	.22	.12	12.83
Operator	.08	.15	.08	10.69
Transportation	.04	.11	.04	13.75
Laborer	.04	.06	.07	4.29
Industry:				
Mining	.01	.017	.01	3.18
Construction	.06	.096	.06	5.69
Retail	.19	.174	.19	1.65
Wholesale	.05	.045	.05	.92
FIRE	.08	.043	.08	6.32
Services	.31	.221	.31	8.21
Manufacturing	.22	.30	.22	8.19
N	166,686	1,876	164,810	

Table 2-4: Descriptive Statistics, Workers' Compensation (WC) Policy Reforms

				State Enacts Reform		
	Live in state that never enacts policy (1)	Live in state that enacts reform (2)	T-stat Col (1) = Col (2) (3)	Before reform (4)	After reform (5)	T-stat Col (4) = Col (5) (6)
WC receipt	.011	.011	1.05	.0131	.0113	1.49
Benefits	350.11 (172.03)	325.76 (149.23)	32.0	325.99 (148.19)	325.74 (149.35)	.15
Wages	662.22 (741.29)	658.52 (829.67)	.94	643.72 (653.02)	660.10 (846.29)	1.79
Replacement rate	.67	.63	35.07	.65	.62	7.99
Maximum benefit in year of injury	556.32 (153.46)	486.70 (94.54)	114.03	485.28 (84.93)	486.85 (95.51)	1.51
Marginal tax rate	.24	.25	19.73	.25	.25	.16
Union membership	.027	.025	2.51	.028	.025	1.74
Share of benefits covered by self-insurance (92-01)	.19	.257	130	.259	.256	2.68
Exposure to Policy Reforms:						
Anti-fraud measures					.62	
Employer chooses doctor					.38	
Stricter medical criteria					.36	
N	72,088	94,598		9,100	85,498	

Table 2-5: Workers' Compensation (WC) Receipt Before and After Large Changes in Prevalence of Self-Insurance

	Year before increase in share self-insurance	Year realize increase in share self - insurance	Year before drop in share self-insurance	Year realize decline in self-insurance
WC receipt	.012	.010	.009	.010
N	26,295	24,944	24,916	27,799

Note: Consider increases or decreases greater in magnitude than five percent

Table 2-6a: Factors Impacting Workers' Compensation (WC) Receipt, Marginal Effects from Probit (z-statistics in parentheses)

			Restrictions Used in Hirsch et al. (1997)	
	(1)	(2)	(3)	(4)
Ln(Benefits)	.004	.004	.001	.001
	(3.80)	(3.78)	(2.10)	(2.08)
Ln(Earnings)	-.002	-.002	.001	.001
	(2.21)	(2.30)	(2.01)	(1.86)
Marginal Tax Rate	-.006	-.007	-.008	-.008
	(3.46)	(3.51)	(4.37)	(4.43)
Union	--	.005	--	.005
		(4.29)		(4.24)
Occup: Manager	-.007	-.007	-.008	-.007
	(7.59)	(7.36)	(8.45)	(8.21)
Occup: Professional	-.006	-.006	-.006	-.006
	(5.70)	(5.55)	(5.86)	(5.71)
Occup: Sales	-.005	-.005	-.006	-.006
	(5.89)	(5.74)	(6.40)	(6.25)
Occup: Clerical	-.006	-.006	-.006	-.006
	(6.31)	(6.17)	(6.63)	(6.48)
Occup: Service	-.003	-.002	-.003	-.003
	(2.47)	(2.40)	(3.04)	(2.97)
Occup: Craft	.001	.001	.0003	.0003
	(.92)	(.92)	(.28)	(.30)
Occup: Operator	.0009	.001	.0004	.0005
	(.77)	(.78)	(.39)	(.41)
Occup: Transportation	.005	.005	.005	.005
	(3.60)	(3.61)	(3.67)	(3.68)
Ind: Mining	.002	.002	.001	.001
	(.81)	(.82)	(.69)	(.68
Ind: Construction	-.0004	-.0003	-.0001	-.0004
	(.43)	(.35)	(.13)	(.04)
Ind: Retail	-.0004	-.0004	-.0004	-.0003
	(.59)	(.49)	(.50)	(.38)
Ind: Wholesale	-.001	-.001	-.001	-.0006
	(1.34)	(1.21)	(.71)	(.56)
Ind: FIRE	-.002	-.002	-.002	-.002
	(2.13)	(2.02)	(2.46)	(2.33)
Ind: Services	-.001	-.001	-.001	-.001
	(1.95)	(1.81)	(1.44)	(1.28)
State Dummies	44	44	50	50
N	166,686	166,686	163,413	163,413
Pseudo R^2	.049	.050	.051	.051
Benefit Elasticity	.4887	.4865	.0924	.0909
Earnings Elasticity	-.2166	-.2259	.1121	.1037

Omitted occupation is laborer; omitted industry is manufacturing. Each specification includes 11 year effects and controls for race and ethnicity. Remaining demographic controls are presented in Table 2-6b. Following Hirsch et al. (1997), in columns (3) and (4) I exclude workers who held more than one job in year t-1 but include workers from all states, no matter how the benefit is calculated (pre- vs. post-tax earnings).

Table 2-6b: Factors Impacting Workers' Compensation Receipt, Marginal Effects from Probit (z-statistics in parentheses)

			Restrictions Used in Hirsch et al. (1997)	
	(1)	(2)	(3)	(4)
Male	-.001	-.001	-.002	-.002
	(2.61)	(2.64)	(2.86)	(2.89)
Age	.0002	.0002	.00004	.0004
	(.86)	(.76)	(1.86)	(1.76)
High School Degree	-.0004	-.0004	.0007	.0007
	(.61)	(.68)	(1.12)	(1.06)
Some College	-.002	-.002	-.0001	-.0002
	(2.49)	(.2.54)	(.17)	(.22)
BA or more	-.006	-.006	-.005	-.005
	(7.13)	(7.11)	(5.97)	(5.94)
Single	-.002	-.002	-.002	-.002
	(2.98)	(2.94)	(3.07)	(3.04)
N	166,686	166,686	163,413	163,413
Pseudo R^2	.049	.050	.051	.051
Benefit Elasticity	.4887	.4864	.0924	.0909
Earnings Elasticity	-.2166	-.2259	.1121	.1037

See notes to Table 2-6a.

Table 2-7: Factors Impacting Workers' Compensation Receipt, Controlling for Policy Reforms

Marginal effects from probit, z-statistics in parentheses

	Baseline (1)	Anti-Fraud Measures (2)	Stricter Medical Criteria (3)	Employer Chooses Doctor (4)	All Policies (5)	Any Policy (6)
Ln(Benefits)	.004	.004	.004	.004	.004	.004
	(3.78)	(3.78)	(3.76)	(3.78)	(3.78)	(3.77)
Ln(Earnings)	-.002	-.002	-.002	-.002	-.002	-.002
	(2.30)	(2.31)	(2.29)	(2.31)	(2.31)	(2.30)
Marginal Tax Rate	-.007	-.007	-.007	-.007	-.007	-.007
	(3.51)	(3.51)	(3.51)	(3.51)	(3.51)	(3.51)
Union Member	.005	.005	.005	.005	.005	.005
	(4.29)	(4.29)	(4.28)	(4.29)	(4.28)	(4.28)
Anti-Fraud Measures		-.0001			-.0005	
		(.09)			(.52)	
Stricter Medical Criteria			.001		.001	
			(1.09)		(1.19)	
Employer Chooses Doctor				.0001	.0001	
				(.13)	(.10)	
Any Policy						.0005
						(.69)
N	166,686	166,686	166,686	166,686	166,686	166,686
Pseudo R^2	.050	.0502	.0503	.0502	.0503	.0502
Benefit Elasticity	.4865	.4871	.4847	.4868	.4881	.4857
Wage Elasticity	-.2259	-.2263	-.2249	-.2261	-.2273	-.2253

Each specification also includes controls for industry, occupation, gender, age, marital status, education, race and ethnicity, 11 year effects and 44 state effects.

Table 2-8: Factors Impacting Workers' Compensation Receipt, Controlling for Lags and Leads of Policy Reforms; Marginal effects from probit, z statistic in parentheses

	Baseline	Anti-Fraud Measures	Stricter Medical Criteria	Employer Chooses Doctor	All Policies
	(1)	(2)	(3)	(4)	(5)
Ln(Benefits)	.004	.004	.004	.004	.004
	(3.78)	(3.82)	(3.77)	(3.80)	(3.83)
Ln(Earnings)	-.002	-.002	-.002	-.002	-.002
	(2.30)	(2.34)	(2.30)	(2.33)	(2.36)
Marginal Tax Rate	-.007	-.007	.007	-.007	-.007
	(3.51)	(3.51)	(3.50)	(3.51)	(3.50)
Union Member	.005	.005	.005	.005	.005
	(.001)	(4.27)	(4.28)	(4.30)	(4.27)
Two years before policy change		-.002	.0002	-.0003	
		(1.39)	(.15)	(.16)	
One year before policy change		-.002	.001	.0009	
		(1.16)	(.75)	(.52)	
Year of policy change		-.0004	.003	-.0004	
		(.25)	(1.61)	(.23)	
First year after policy change		-.0005	.0004	.0002	
		(.31)	(.17)	(.11)	
Second year after policy change		-.003	.001	-.0005	
		(1.74)	(.59)	(.25)	
Third year and beyond after policy change		-.001	.001	.0009	
		(1.00)	(.96)	(.62)	
N	166,686	166,686	166,686	166,686	166,686
Pseudo R^2	.0502	.0505	.0504	.0503	.0507
Benefit Elasticity	.4865	.4930	.4856	.4896	.4954
Wage Elasticity	-.2259	-.2297	-.2257	-.2281	-.2321

Each specification also includes controls for industry, occupation, gender, age, marital status, education, race and ethnicity, 11 year effects and 44 state effects.

Table 2-9: Factors Impacting Workers' Compensation Receipt, 1992-2001, Controlling for Share of Benefits Paid by Self-Insured Employers;
Marginal effects from probit, z-statistics in parentheses

	Baseline (1)	All Policies (2)	Self-insurance (3)	All Policies + Self-insurance (4)	Heterogeneous effects (5)
Ln(Benefits)	.004	.004	.004	.004	.004
	(3.19)	(3.21)	(3.16)	(3.18)	(3.21)
Ln(Earnings)	-.002	-.002	-.002	-.002	-.002
	(2.15)	(2.17)	(2.12)	(2.15)	(2.18)
Marginal Tax Rate	-.007	-.007	-.007	-.007	-.007
	(3.50)	(3.50)	(3.51)	(3.51)	(3.51)
Union Member	.005	.005	.005	.005	.005
	(3.43)	(3.44)	(3.44)	(3.45)	(3.35)
Share Benefits Covered by Self- Insurance			-.008	-.010	
			(1.31)	(1.50)	
Share Self-insurance * Work in Manufacturing Industry					-.0136
					(1.96)
Share Self-Insurance * Do not Work in Manufacturing					-.007
					(1.08)
N	122,875	122,875	122,875	122,875	122,875
Pseudo R^2	.0526	.0534	.0527	.0535	.0530
Benefit Elasticity	.4950	.4999	.4898	.4952	.5045
Wage Elasticity	-.2533	-.2564	-.2507	-.2544	-.2615

Each specification also includes controls for industry, occupation, gender, age, marital status, education, race and ethnicity, 8 year effects and 44 state effects.

Figures for Chapter 2

Figure 2-1: Union Membership in the 1990s

Source: Author's calculations from Current Population Survey

Chapter 3: The Impact of Incentives to Reduce Workers' Compensation Claim Duration: Are Third-Party Case Managers Effective?

3.1 Introduction

Classifying WC policy reforms into different categories obscures important details about state WC programs and the nuances of different policies. In this chapter I examine one reform enacted by the state of Ohio, one of five states in which employers must purchase WC insurance from the state (or self-insure). In response to rising employer costs, the state contracted out WC case management responsibilities to companies called Third-Party Case Managers (TCMs) with the hope that, as private companies, TCMs might be able to get injured workers back on the job more efficiently than if the state continued to manage WC claims.[35] To be clear, in this chapter I am considering the impact of a policy change on the intensive margin, or how long an injured worker remains away from work, and not the extensive margin, the decision of whether or not to claim WC.

The term "case management" refers to an insurer's efforts to get an injured worker back on the job sooner through innovations such as coordinating with employers to accommodate the claimant, lobbying for doctors to release claimants to modified work, and by encouraging injured workers to go back to their jobs in an attempt to reduce moral hazard. If there are economies of scale to effectively implementing these approaches, TCMs that manage many claims should be more successful than individual employers in reducing the amount of time workers miss from their jobs.

[35] In Ohio and the larger WC community, TCMs are referred to as Managed Care Organizations (MCOs); however, I refer to them as TCMs to avoid confusion with health insurance MCOs, which are structured differently.

Two years after the TCMs were introduced in Ohio, the state incorporated a bonus incentive payment intended to reward the TCMs for getting injured workers back on the job sooner. The impact of this bonus payment on claim duration is the focus of this paper. The exact structure of the payment is quite intricate, but it is essentially a decreasing function of the average days away from work for claims meeting two criteria. First, the state selected a subset of detailed injuries to "incentivize," so a claim is only included in the payment calculation if the worker is diagnosed with one of the "incentivized" injuries. The incentivized injuries were chosen because they represent medical conditions for which a guideline number of days away from work could be identified. Second, a claim having an incentivized injury is excluded from the calculation of average days away from work if the injured worker does not return to his or her job within 15 months. As a result of this provision, the policy does not penalize TCMs for a particularly bad draw of claims. However, it gives TCMs a perverse incentive to actually *increase* duration for some claims with incentivized injuries so that the claimants miss more than 15 months and are then excluded from the calculation of average days away from work used to compute the bonus payment.

Therefore, the structure of the bonus payment suggests that a profit-maximizing TCM will react with heterogeneous responses as a claim develops over time. It takes an average of seven days after an injury for a TCM to learn of the claim from the doctor. So if the injured worker returns to work before one week passes, the TCM does not intervene on the claim and has no response to the incentive structure of the program. If the injured worker is still away from work when the TCM learns of the claim, the case manager will initially attempt to get the injured worker back on the job as soon as possible. The case

manager will continue to endeavor to expedite return-to-work until the claim extends long enough that the claimant could feasibly remain out of work past 15 months. At this point, it is profitable for the TCM to extend the claim beyond 15 months so that it is excluded from the bonus payment calculation. One possible way a case manager might extend a claim is by enrolling the injured worker in vocational rehabilitation, a mix of lengthy programs that re-train claimants for the workplace.

I find TCMs were quite responsive to the bonus payment; within three calendar quarters of its implementation, three-quarters of all TCMs received the bonus payment. To test whether the TCMs maximized the bonus payment by attempting to reduce duration for moderately severe claims and increasing duration for severe claims, I acquired administrative claims data for all claims occurring between 1995 and 2002. I use the variation in the implementation of these policies over time and across injury to determine whether or not the policy changes have any impact on claim duration. The structure of the payment suggests the bonus will not have any effect on the most minor claims because these claimants return to work before the TCM becomes involved, and this is confirmed in the data. The case managers are predicted to successfully reduce duration for those claimants having moderately severe injuries because as soon as claims are filed, the injured workers are exposed to an aggressive return-to-work campaign. Although I find no evidence that the bonus induces duration to decrease, results from quantile regression confirm that duration does not increase for these claims.

Duration is predicted to increase for claimants with severe injuries because claims lasting longer than 15 months are excluded from the calculation of the bonus payment. I test for this response in several ways and conclude the bonus increases duration for

severe claims with incentivized injuries. Restricting attention to severe claims, I find that the bonus increases average days away from work by about three weeks for claims having incentivized injuries. Quantile regression results confirm these increases are concentrated at the top of the conditional distribution of claim duration. I verify that this corresponds to the predicted strategic behavior on the part of the TCMs because the probability a claim spans more than 15 months rises by 30 percent for claims having an incentivized injury. Thus, the bonus actually leads to an *increase* in days away from work among the most severe claims. In WC, the most severe claims comprise a disproportionate share of program costs. Therefore, this increase in days away from work among the most expensive claims suggests the intended reduction in employer costs was not realized.

With the Ohio administrative data, I am able to test one mechanism that case managers may use to influence claimants to remain out of work past 15 months—enrollment in vocational rehabilitation programs. I calculate that participants begin to receive vocational rehabilitation an average of ten months after their injury and the rehabilitation programs last over six months. On average, the timing of the program is consistent with its use as a method to strategically increase duration past 15 months. Furthermore, benefits paid for vocational rehabilitation do not impact an employer's premiums and several TCMs have a second financial incentive to enroll injured workers in vocational rehabilitation. Six of the largest TCMs are subsidiaries of companies that also own rehabilitation providers.[36] By enrolling injured workers in vocational

[36] Before the privatization of WC, these services were provided by the state. Private WC vocational rehabilitation providers were formed after the implementation of TCMs. Paynter, Bob. October 26, 2006. "Big money to be made in referrals for rehab; Rehab, Managed-care system for Workers' Comp hurt the workers, critics say." *Cleveland Plain Dealer*, A1.

rehabilitation, the TCM can maximize the bonus payment and the rehabilitation company receives business from the state. Consistent with this prediction, I find that after the bonus is in place, claims having incentivized injuries are nearly fifty percent more likely to receive vocational rehabilitation benefits. Thus, the bonus appears to have a measurable impact on days away from work in ways consistent with a profit-maximizing TCM responding to the bonus payment.

The impact of the bonus payment on the duration of claims having an incentivized injury is the focus of this paper, but I also estimate the overall effect of TCMs because it is possible that the simple act of contracting out services impacted claim duration. When the TCMs were first introduced, they were mandated to provide insurance cards to all employers whose claims they managed. This infrastructure change may have influenced claim duration by getting injured workers to their first doctor's appointment sooner, with the biggest impact expected to accrue to individuals with minor injuries. To quantify this, I must assume that the introduction of TCMs was the only change to duration in Ohio between 1995 and 2002, an assumption that is unlikely to hold. Nevertheless, I find that after the TCMs began operation average duration fell for all minor claims, even if the claim had a non-incentivized injury. In total, although contracting out services to TCMs modestly reduces days away from work for the majority of minor claimants, the net result of the bonus payment is an overall increase in days away from work. Using reasonable assumptions about the amount paid in cash benefits and the value of a worker's productivity, I estimate the bonus payment may cost the state between $26.4 and $39.4 million per year.

3.2 Third-Party Case Managers and the Bonus Payment

3.2.1 Third-Party Case Managers and Ohio

Third-Party Case Managers are private companies that assume WC case management responsibilities. These companies are used nationwide to reduce employer costs by facilitating return-to-work for injured workers; the companies are especially popular among employers that self-insure WC because they eliminate the need for in-house claims management.[37] In Ohio, TCMs are currently managing every claim insured by the state.[38] The TCMs were implemented in Ohio in two phases, as shown in Figure 3-1. In 1997, the state contracted out case management services to TCMs in hopes of curbing employer costs.[39] Case management involves medically managing claims and expediting return-to-work.[40] After the introduction of TCMs in Ohio, injured workers, employers, and doctors no longer interact with the state. The second policy change, and the main focus of this paper, was the incorporation of a bonus payment intended to reward the TCMs for reducing claim duration.

The TCMs began operation in 1997, and by the beginning of 2007 there were 27 TCMs in Ohio, with four of them managing 70 percent of claims (Ohio Bureau of Workers' Compensation, 2006).[41] Employers continue to pay premiums to the state but

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[37] For example, Blue Cross Blue Shield advertises a Third-Party Administration Plan to self-insured employers in Florida. http://www.bcbsfl.com/index.cfm?fuseaction=WORKERSCOMP.selfInsured, viewed 9/24/07. Ryder System Inc. is an example of a self-insuring employer that sought to hire nurses to manage claims. Quint, Michael. "Crackdown on Job-Injury Costs." *The New York Times,* March 16, 1995. Section D, Page 1, Column 2.

[38] Several other states, such as Tennessee and Texas, mandate the use of formalized case management, but do not require that third parties manage the cases.

[39] The legislation was passed in 1993.

[40] In Ohio, medical management of a claim consists of filing the claim with the state, providing initial approval of requested medical procedures, and directing state reimbursement to medical providers.

[41] They are CareWorks, CompManagement HealthSystems, GatesMcDonald HealthPlus, and Sheakley UNICOMP.

select which TCM will manage their claims during open enrollment every two years.[42] During this intermediate period before the return-to-work bonus payment was implemented, the state compensated TCMs as a function of the share of total premiums managed by the TCM.[43] Beginning in 1999, the state incorporated a bonus payment that was a decreasing function of average days away from work for some claims.[44]

The TCMs are mandated to provide insurance cards to every employer whose claims they manage. After an injured worker informs his or her employer of the injury, the employer gives the injured worker a TCM insurance card identifying which TCM manages the claim. An injured worker then receives care from any doctor of his or her choice. The TCM insurance card informs the doctor's office where to file the claim and submit the bill. The introduction of these insurance cards alone may streamline the path between injury and the first doctor's appointment, and this may reduce average duration for all minor claims, whether or not the claim has an incentivized injury. The doctor makes a diagnosis and assesses if the injury is work-related. The physician then reports the claim to the employer's chosen TCM. The TCM learns of the claim after an average of seven days, reports the claim to the state, and assigns the claim to a case manager (Ohio Bureau of Workers' Compensation, 2006).[45] At this point, the case manager is required to contact the doctor, the employer, and the injured worker to manage the claim and acquire the necessary information to verify the injury and confirm it is work-related.[46]

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[42] 2006 MCO Agreement. Acquired from a public records request. Chapter 1, page 43.
[43] Donchess, Joel, Ohio Bureau of Workers' Compensation, personal communication, April 24, 2007.
[44] 2006 MCO Agreement. Acquired from a public records request. Appendix E.
[45] Case managers are often nurses.
[46] Information from each party is required for the TCM to file the claim with the state. 2006 MCO Agreement. Acquired from a public records request. Chapter 2, page 10.

After these contacts, the case manager might attempt to reduce claim duration. According to individuals at some of Ohio's largest TCMs, the organizations use three strategies to decrease days away from work. First, case managers encourage aggressive medical treatment, in which workers are treated and returned to work as soon as possible. Second, the case managers monitor injured workers in an effort to get the claimants to return to work sooner and reduce moral hazard. Third, case managers encourage employers to accommodate injured workers on the job.[47]

At each medical appointment for a work-related injury, the doctor fills out a form identifying the activities the claimant is released to do on the job. Within the restrictions outlined on this form, the case manager helps the employer identify ways the injured worker might be useful in the workplace. For example, a nurse's aide who suffers from a back injury might be released to do seated work that does not require lifting more than ten pounds, such as folding towels or performing clerical duties.[48] The case manager also monitors injured workers and encourages them to return to work. If the claimants cannot return to their former positions, the TCM might advocate vocational rehabilitation benefits. When workers receive vocational rehabilitation, they receive career counseling, assessment, and training.[49]

3.2.2 The Return-to-Work Bonus Payment

Two years after the TCMs were implemented, the state restructured TCM compensation to incorporate a performance-based component, the bonus payment. The bonus was

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[47] Curry, D., GatesMcDonald, personal communication, August 11, 2006.
Kafiti, Anthony. 888-OHIOCOMP, personal communication, August 14, 2006.
[48] The worker may work fewer hours or be paid a lower wage if he or she cannot work at full capacity.
[49] Paynter, Bob. October 26, 2006. "Big money to be made in referrals to rehab; Rehab, managed-care system for Workers' Comp hurts the workers, critics say." *Cleveland Plain Dealer*, A1.

intended to reward TCMs for effectively reducing claim duration.[50] It is paid each quarter and is essentially a decreasing function of average days away from work for eligible claims, subject to a maximum amount. The bonus payment comprises over forty percent of TCM compensation, and in FY 2004, the TCMs earned approximately $70 million in bonus payments (Ohio Bureau of Workers' Compensation, n.d.).[51] Figure 3-2 depicts the share of TCMs receiving the bonus payment in each quarter since its inception. As is clear from the figure, TCMs responded to the incentives inherent in the program. The solid line depicts the share of TCMs receiving any bonus payment, and the dashed line plots the share of TCMs receiving the full bonus payment. Within three calendar quarters, nearly all TCMs began to receive some bonus payment, and over half of all TCMs received the maximum amount.

A claim must meet two criteria to be included in the calculation of days away from work for the bonus payment. The injured worker must have been diagnosed with an incentivized injury and the injured worker must return to his or her job within 15 months. Five-digit ICD-9 codes are the detailed injury codes used internationally by doctors to diagnose patients.[52] Some of these codes correspond to common workplace injuries for which it is straightforward to identify a goal or benchmark number of days away from work. For example, it is much easier to identify optimal duration for injured workers suffering from superficial cuts than for traumatic head injuries.[53] Therefore, to facilitate

[50] The TCMs were aware that the structure of compensation would incorporate a performance-based component, but the exact structure of the bonus payment was not known to TCMs until 1999. The state waited two years to implement this incentive payment to give the TCMs a chance to adjust to the process of managing claims.
[51] 2006 MCO Agreement. Appendix E, page 13. Acquired from a public records request.
[52] The codes are so detailed that at least 22 codes describe pain in the back or neck.
[53]These benchmarks are not available through public records requests from the state because they are proprietary. They were derived from Milliman and Robertson, Healthcare Management Guidelines, Volume 7.

performance-based evaluation of TCMs with different injury mixes, the state chose to incentivize 266 detailed ICD-9 codes with well-defined benchmarks. Only claims having one of these diagnoses or injuries are included in the calculation of the bonus payment.[54] In Table 3-1, I present detailed injury codes by incentivized status for the 20 most common injuries in each category. This table shows the level of detail of the injury codes and that many types of injuries are common to both groups, such as back sprains, bruises, and cuts.

Claims also must meet a second criterion to be included in the bonus payment. A claim having an incentivized injury will be excluded from the calculation if the injured worker does not return to work within 15 months.[55] This provision effectively shelters TCMs from a particularly bad draw of claims, but also creates a perverse incentive for TCMs to increase the duration of some claims to ensure they are not included in the calculation of the bonus payment. Suppose a is the mean days away from work for the claims used to compute a TCM's bonus payment and b is the mean of the benchmarks corresponding to these injuries. The bonus payment is a decreasing function of a-b. The lower a TCM's actual experience (a) is relative to the goal for that TCM (b), the higher the bonus payment.[56] Therefore, a TCM can lower mean days away from work (a) by

[54] The conditions were also selected because there were enough claims for each injury prior to the incentive implementation to construct the mean number of days missed by workers having such conditions.

[55] In practice, the incentive is more complex as it is based on quarters of the calendar year, reflecting the return-to-work experience of the previous five quarters. For example, the incentive payment for Q1 in 2007 is based on spells that began and ended between Q4 2005 and Q4 2006. Consider injuries occurring in Q4 2005; these injuries must return to work before January 1, 2007 to be included in the incentive payment. Thus, an injury occurring on October 1, 2005 must miss 15 months of work before it is excluded from the average calculation. In contrast, an injury occurring on December 31, 2005 must only miss 12 months of work before being excluded from the calculation. I refer to this provision as "15 months" for simplicity but incorporate this complexity in my empirical work.

[56] To be precise, the incentive=max(0,f[(a-b)/(c-b)]) where a=actual average days away from work, b=average benchmark days away from work, c=average counterfactual days away from work, and f is a decreasing function of [(a-b)/(c-b)]. Each quarter, the average days away from work is are computed for those claims that have one of the "incentivized" conditions and began and ended within the past 15 months.

ensuring those claims that could feasibly result in a loss of more than 15 months of work in fact remain out of work so long they are not included in the bonus payment.

3.3 Expected TCM Responses and the Expected Impact on Days Away from Work

3.3.1 Expected Impact of the Introduction of TCMS (no Bonus Payment)

Recall that when the TCMs were first implemented, TCM compensation was strictly a function of the share of total premiums the TCM managed. Under this condition, a profit-maximizing TCM might be expected to reduce claim duration in order to remain attractive to employers. If a TCM successfully returns injured workers to their jobs, premiums for experience-rated employers will fall. However, there are two reasons employers may not have responded to TCM performance by switching to TCMs with better return-to-work outcomes.

First, Ohio employers were insulated from the full impact of their loss histories. After an extended period of rising employer costs in Ohio, the state insurer had unexpected excess reserves during the time of these policy reforms. The state chose to return this surplus to employers in the form of large premium rebates. Between July 1, 1997 and December 31, 2002, employers were eligible for premium rebates of at least *75 percent*.[57] Thus, even the premiums paid by the most dangerous employers were greatly reduced, overshadowing any impact the TCM may have had on premiums. Second, employers may have had a difficult time evaluating and differentiating between TCMs.

The state also computes that quarter's average of the corresponding benchmark (b) and counterfactual (c) days away from work for the injuries included in that quarter's payment.

[57] Personal Communication, Elizabeth Bravender, Ohio Bureau of Workers' Compensation, August 3, 2006. In 1998, employers received an even larger refund.

Although the state publishes analyses describing TCM performance to better help employers select among TCMs, few employers have much interaction with their selected TCMs. Most employers have fewer than ten claims per year, and about 80 percent of these claims are resolved before the TCM becomes involved. For this reason, the bulk of employers may not have been compelled to switch TCMs, and maintaining employer clients was unlikely to have been an important aspect of the TCM profit function during this period. Using Ohio administrative claims data, I calculate that fewer than ten percent of employers switch TCMs each year, providing further support for this claim. Therefore, I assume that the marginal benefit to a TCM for reducing a claim's duration during this period is near zero.

Given the infrastructure changes mandated by the state, the structure of TCM compensation, and employer behavior, the impact of the TCM on claim duration is predicted to change as a claim develops from the date of injury. To illustrate this, I make a few simplifying assumptions. First, I assume that every claim in the TCMs portfolio was injured on the same day. I also assume that when a TCM decides whether or not to attempt to reduce duration, the TCM makes the decision to act considering the entire portfolio of claims. I make this assumption because it is difficult to predict a claim's duration, especially early in the claim. Suppose case managers make calls each week, then each week the case manager assesses whether the marginal benefit of calling the entire portfolio of claims outweighs the marginal cost of these calls.

In Figure 3-3a, I illustrate the marginal costs and benefits associated with reducing duration. The horizontal axis measures time away from work if the TCM attempts to reduce duration, called d^{RED}. There are no marginal costs or benefits

associated with the first week a worker misses of work because the TCM cannot impact duration before the claim is filed.[58] For claims that would return to work within one week, only infrastructure changes, such as insurance cards, can influence duration. These infrastructure changes may have streamlined the path to the first doctor's appointment and reduced duration. Therefore, duration is predicted to decrease for minor claims. For claims lasting longer than one week, the marginal cost of reducing claim duration always exceeds the marginal benefit because of the assumption that maintaining employer clients was not an important component of a TCMs profit function. Thus, before the bonus was implemented, case managers had no incentive to influence claim duration above and beyond the impact of infrastructure changes such as insurance cards.

3.3.2 Expected Impact of the Bonus Payment on Incentivized Injuries

After the second policy change, the introduction of the bonus payment, TCMs may respond by affecting claim duration or by influencing doctors to strategically re-label injuries as incentivized or non-incentivized. Although strategic re-labeling is present in response to other public programs (e.g., Dafny, 2005; Fisman and Wei, 2004; and Silverman and Skinner, 2004), I do not expect to find such a reaction to the bonus payment. A doctor diagnoses an injured worker before the claim is even filed with the TCM. For strategic re-labeling to be successful, TCMs would have to convince doctors to comply even though the doctors do not directly benefit from a higher bonus payment. In Appendix A, I examine strategic re-labeling and confirm that doctors do not appear to

[58] I assume that providing insurance cards incurs a small, fixed cost.

be manipulating claims in this way. Therefore, I focus on the incentives facing TCMs to impact days away from work.

The bonus payment is predicted to impact claim duration differentially for claims having incentivized and non-incentivized injuries. The case managers are predicted to treat claims with non-incentivized injuries in the same way before and after the bonus payment is implemented (Figure 3-3a). For claims having incentivized injuries, recall that the bonus is essentially a decreasing function of average days away from work for claimants that return to work in less than 15 months. Therefore, the structure of the bonus suggests that a profit-maximizing TCM will react with heterogeneous responses as a claim develops over time. These actions correspond to changes in duration that vary by a claim's underlying severity.

Figure 3-3b characterizes the marginal costs and benefits associated with reducing claim duration for incentivized injuries once the bonus payment is in place. As in Figure 3-3a, there are no marginal costs or benefits before claims are filed in the first week after injury. Once the TCM learns of the injury, the marginal cost of reducing duration remains the same—the cost of a phone call. However, the marginal benefit now exceeds the marginal cost because the bonus payment is a function of duration for injured workers having incentivized injuries. In a given week, the marginal benefit to the TCM for claim reduction efforts is the change in the bonus payment that arises from workers returning to their jobs that week instead of when they would have returned in the absence of any intervention. The marginal benefit falls over time because the bonus is a decreasing function of average days away from work. When the TCM first learns of the claim, the marginal benefit to a TCM of reducing duration exceeds the marginal cost of these

efforts. Therefore, claimants are exposed to an aggressive return-to-work campaign after one week away from work. A characteristic of many TCM data management systems suggests case managers can focus these efforts on claimants with incentivized injuries. In many TCMs, the data management system used to track claims informs the case managers whether the claim has an incentivized injury, the injury's goal days away from work, and the amount of time since the injury.[59]

Recall that claims that extend longer than 15 months are excluded from the bonus payment. Thus, there is a threshold beyond which it benefits TCMs to encourage claimants to remain out of work past 15 months. A TCM might do this in two ways: actively increase a claim's duration or ignore the claimant in the hope that the worker will return to the job once 15 months have passed.[60] To illustrate this point, I define two additional measures of duration for each worker. Recall d^{RED} quantifies the number of days a worker misses if the TCM attempts to reduce duration. If the TCM does not intervene at all, a claim's duration is given by d^{OH}, which can be thought of as the counterfactual or amount of time the injured worker would have missed if the injury had occurred when the state of Ohio managed claims. If the TCM attempts to make an injured worker remain out of work longer, the claim would miss d^{LONG} days away from work. The TCM is predicted to actively increase duration for claims with incentivized injuries having d^{LONG}>15 months, the threshold beyond which TCMs benefit if the claimant remains out of work past 15 months. The case manager might use enrollment in

[59] Ohio Employee Health Partnership. http://www.systoc.com/Tracker/Summer99/DoDM.htm viewed 8/12/06
Lori Newhouse, CareWorks, personal communication, August 18, 2006.

[60] The TCM has an incentive to identify these claims and not invest in reducing duration, but this is difficult to do. Therefore, the case manager may unsuccessfully attempt to get these claimants back to work early in the claim.

vocational rehabilitation to increase duration for these claims. Furthermore, TCMs have a second financial incentive to enroll injured workers in vocational rehabilitation programs; the largest TCMs are subsidiaries of companies that also own vocational rehabilitation providers.

Some injured workers will miss more than 15 months of work even if the TCM does not attempt to make the claim longer (d^{OH}>15 months), so the TCM does not need to actively increase duration for these claims. However, these claims are difficult to identify so it is an empirical question whether or not the TCM actively works to increase duration for all claims past the threshold beyond which TCMs benefit if the claimant remains out of work past 15 months or ignores some claims—those that will miss 15 months no matter what the TCM does. I explore this matter in the empirical section. The five largest TCMs and their affiliated vocational rehabilitation providers are CareWorks (VocWorks), CompManagement HealthSystems (Integrated Benefits Management), GatesMcDonald HealthPlus (unnamed affiliate), Sheakley Unicomp (Parman Group), and 1800OHIOCOMP (VocRehab One).[61]

3.3.3 Literature

Although no previous study addresses this link between TCMs and claim duration, evidence from other work suggests that TCMs should be effective in impacting claim duration. In order to bring claimants back to work sooner, the case managers work with employers to accommodate injured workers on the job. There is evidence showing that

[61] Paynter, Bob. October 26, 2006. "Big money to be made in referrals for rehab; Rehab, Managed-Care system for Workers' Comp hurt the workers, critics say." *Cleveland Plain Dealer*, A1. The unnamed affiliate of GatesMcDonald HealthPlus is referenced at www.gmcdhealthplus.com/HealthPlus/employer-services.jsp#vocational-rehab. Viewed May 21, 2008.

employer efforts to provide modified work or light duty to a recovering worker successfully reduce claim duration. Using administrative claims data from Minnesota, Krueger (1991) shows that duration is shorter for employees whose employer is self-insured than for those whose employer is privately or publicly insured. Self-insured employers bear the full cost of each claim, so Krueger hypothesizes that self-insured employers are more likely to speed return-to-work by offering modified work or more closely monitoring a worker's recovery. This result suggests that case managers could successfully reduce claim duration by facilitating return-to-work with employers.

If return-to-work efforts are unsuccessful, and the claim has exceeded the threshold beyond which it benefits the TCM for the claim to miss more than 15 months of work, the TCM may attempt to increase duration. A case manager might successfully extend a claim past 15 months by enrolling claimants in lengthy vocational rehabilitation programs. For this mechanism to be effective, the injured workers must choose to participate in the program. Aakvik and Kjerstad (2003) estimate the determinants of participation in Norwegian vocational rehabilitation programs. They find displaced workers are more likely to participate in vocational rehabilitation programs if the individual is eligible for cash benefits while receiving the training and the individual was employed the year before vocational rehabilitation was offered. If the relationship between cash benefits, program timing, and participation in vocational rehabilitation is similar for Ohio injured workers, these results suggest case managers will be able to successfully enroll injured workers in lengthy rehabilitation programs. In Ohio, injured workers continue to receive cash benefits while in vocational rehabilitation. Furthermore, if a case manager uses vocational rehabilitation to ensure claimants remain

away from work for more than 15 months, the injured worker needs to begin the rehabilitation program approximately one year after injury.

The case manager may simply ignore those claimants that would miss more than 15 months in the absence of TCM intervention and allow them to remain away from work past 15 months. For this to be effective, the TCM relies on the assumption that injured workers will continue to remain away from work if allowed to do so. The WC literature has established that claims are responsive to benefit levels. As confirmed in Chapter 2, when benefits become more generous, injured workers are more likely to claim cash benefits (Bronchetti, 2007; Hirsch et al. 1997; Krueger, 1990; Neuhauser and Raphael, 2004; Ruser et al., 2004; and Ruser, 1985) and receive those benefits longer (Butler and Worrall, 1985; Krueger, 1991; Meyer et al., 1995; and Neuhauser and Raphael, 2004). Although the magnitude of the elasticity is sensitive to the dataset used as well as to the specification, it is always positive, providing evidence that workers respond to incentives. This result suggests some claimants might willingly remain out of work until 15 months pass, lending support for the hypothesis that the case manager will be able to ignore these particularly severe claims until they extend to the point they are excluded from the calculation of the bonus payment.

3.4 Data and Econometric Approach

3.4.1 Data Description

To assess the impact of the bonus payment intended to reduce WC claim duration, I have acquired administrative claims data from the Ohio Bureau of Workers' Compensation,

the state insurer. The dataset includes information on all injuries occurring between January 1, 1995 and June 30, 2002 and follows each claim for three years. For each claim, the dataset contains information on days away from work, the diagnosis for the injury (five-digit ICD-9 code), demographic characteristics (age, sex, and marital status), job characteristics (1-digit industry and 1-digit occupation), and identifiers for the employer and the TCM. I exclude observations that are missing data or where the injured worker received a death benefit, permanent disability award, or lump-sum settlement within three years of the injury.[62] The extent of these sample restrictions on the data is shown in the first six rows of Table 3-2.

I also drop claims that are missing return-to-work information. This exclusion demands careful treatment because it differentially impacts medical only claims, those claims that return to work within one week and do not receive cash benefits. For claimants receiving cash benefit payments, the state maintains a complete transaction history that details each cash payment made to a claim. This file quantifies the type of payment made and the dates covered by each check. I assume cash benefit claimants return to work when benefits cease.[63] Between 42.8 and 44.3 percent of cash benefit claims having incentivized injuries are missing return-to-work information, and this information is missing for between 48.8 and 51.9 percent of non-incentivized injuries

[62] By law, claimants awarded either permanent death or total disability benefits are excluded from the incentive calculation. 2006 MCO Agreement. Chapter 2, page 54. Claims receiving permanent partial disability benefits or lump sum settlements are excluded because receipt of these benefits does not depend on whether or not an individual is working. Therefore, I cannot infer when the injured worker returned to work.

[63] This is a nontrivial assumption, but it is confirmed in the data. For 94 percent of cash benefit claimants, I have two sources of return-to-work information. In addition to the complete transaction history of all cash benefit payments, recipients also appear in a file of return-to-work dates (1.3 percent are assumed to be censored because they receive benefits continuously for five years and return-to-work dates are missing for the remaining 5 percent). For 81 percent of those cash benefit claimants with both sources of information, the return-to-work date is the same as that constructed by the cessation of benefits. Furthermore, the main results of the paper are upheld when I drop those non-censored cash benefit claimants missing return-to-work information or whose information is incongruent.

(see Appendix B). Thus, the rate of missing data for cash benefit claimants is roughly constant over the three time periods and assumed to be missing at random.[64]

In contrast, instances of medical only claims missing return-to-work information pose a much more nuanced problem for analyzing the impact of the bonus payment on days away from work. By definition, medical only recipients never receive cash benefit checks, so a separate file captures the date each worker actually returns to his or her job. Before the implementation of the bonus, the state insurer simply needed to verify claimants did not miss more than one week of work. After the bonus was put in place, it became much more important for the state to capture return-to-work information for medical only claims with *incentivized* injuries because the days away from work for these claims were now used to calculate the bonus payment. Consistent with these incentives, the share of medical only claims with incentivized injuries missing return-to-work data fell once the bonus is in place (from 56.9 percent to 9.3 percent). In contrast, the corresponding decline among non-incentivized injuries was somewhat smaller. Before the bonus was in place, 57.6 percent of medical only claims having non-incentivized injuries were missing return-to-work data. Once the bonus was implemented, the share of these claims that were missing data fell to 11.8 percent, a slightly smaller reduction. Return-to-work information is not missing at random for medical only claims. Failing to account for this non-randomness would result in a sample of claims comprised of relatively more medical only claims. Since medical only claims are shorter in duration, the changing sample composition will drive a mechanical decline in days away from

[64] I selected a random sample of claims and compared them with the OH BWC database to confirm that return-to-work information is complete for the claims reporting it, but missing at random, at least based on observables about the injured worker and the injury, for claims without any return-to-work information.

work in the empirical results. Therefore, I weight all results by the inverse probability that a claim has valid return-to-work information.[65]

I make the final two restrictions so that the different specifications are computationally feasible. Claims are preserved only if the injury designation appears in each of the three time periods (before the TCM is introduced, once the TCM is managing claims but before the bonus is implemented, and the period when the TCM and bonus are both in place). This restriction effectively accomplishes two things; it drops the injuries with the fewest number of claims and ensures the sample of injuries is the same in each period.[66] I further restrict the sample to those injuries that have more than 100 claims in each period.[67] The final baseline sample has 491,533 observations.

3.4.2 Descriptive Statistics

Table 3-3 contains descriptive statistics for the outcome of interest, days away from work, separately for claims with incentivized injuries (treatment group) and non-incentivized injuries (comparison group). The first panel contains results for the full sample of injuries. The first striking thing about this comparison is that average duration is quite different for the two groups. Claimants having non-incentivized injuries return to work in an average of about four days. This is much more quickly than average return-

[65] I estimated the probability a claim has valid return-to-work information using a linear probability model where the dependent variable is equal to one if an observation has valid return-to-work information. The controls include demographic characteristics, employer controls, TCM fixed effects, and injury indicators. These covariates are allowed to vary by (1) whether or not the claim has an incentivized injury, (2) when the injury occurred (PRE, POST1, POST2), and (3) whether or not the claim received medical only or cash benefits. Claims with valid return-to-work information are preserved in the final sample and weighted by the inverse of the predicted probability a claim has valid duration information.

[66] There are 599 diagnosis codes with fewer than three claims. By definition, this restriction drops these injuries.

[67] The main results are not sensitive to this restriction. The results are qualitatively similar when the sample is cut to preserve injuries with at least 25 or 500 injuries each period.

to-work for claimants having incentivized injuries, who return to work in an average of about two weeks. This suggests the state may have chosen to incentivize the most costly workplace injuries. Although this may be a desirable policy, it means that non-incentivized injuries might not be an ideal comparison group. To address this concern, I present results for the whole stock of injuries as well as those with three-digit ICD-9 codes comprised of both incentivized and non-incentivized injuries, a set of more comparable injuries. I also conduct the analysis separately for the three most common types of injuries: back sprains, bruises, and cuts. Within the samples of bruises and cuts, mean days away from work are rather similar for both incentivized and non-incentivized injuries.

I quantify the impact of TCMs beginning to manage claims by comparing duration before the TCMs were implemented (PRE) with outcomes once the TCMs were in place (POST1). Since the TCMs were not initially rewarded for impacting claim duration and employers had little motivation to switch TCMs, duration is predicted to change only as a result of the infrastructure changes which are expected to impact minor claims. Table 3-3 shows that mean days away from work for non-incentivized injuries fell from 4.4 to 3.8, a statistically significant reduction of about half of one day, or 14 percent.[68] Similarly, mean days away from work declined among claims having incentivized injuries, from 14.1 to 12.5. Table 3-3 also shows how changes in the mean are driven by changes across the distribution of days away from work. There is a modest decline in days away from work throughout the whole distribution of claim duration. For example, among claims having non-incentivized injuries the 75th percentile fell from four

[68] Reported results are weighted by the inverse of the predicted probability a worker has valid return-to-work information. As expected, descriptive statistics for days away from work are sensitive to weighting.

days in PRE to three days in POST1. Similarly, among incentivized injuries the 75th percentile dropped from five to four days. These decreases in days away from work are consistent with infrastructure changes successfully reducing duration across the distribution of claim duration, and I will investigate whether this conclusion persists after controlling for the composition of injured workers.

To assess the impact of the bonus payment, I compare outcomes for injured workers when the TCMs are managing claims (POST1) with outcomes once the bonus is in place (POST2). This approach assumes all infrastructure changes were realized in POST1 and the only differences in duration in POST2 arise from the bonus payment. Since the bonus does not apply to non-incentivized injuries, I expect to find no further change in duration among non-incentivized injuries. As expected, Table 3-3 shows only modest changes in days away from work among non-incentivized injuries. For example, mean duration changed from 3.8 days to 4.0, yet this difference is not statistically significant and there were only modest changes across the entire distribution of days away from work.

For incentivized injuries, the TCMs are predicted to have heterogeneous responses to the bonus payment. Only infrastructure changes impact duration before the TCM learns of the claim, so no change in duration is expected between POST1 and POST2 for minor injuries. After one week, TCMs are predicted to actively reduce claim duration until the claim exceeds the threshold beyond which the bonus payment increases if the claim misses more than 15 months. At that point, I expect duration to increase. Therefore, the expected impact of the bonus on mean days away from work for incentivized injuries is ambiguous because the predicted heterogeneous responses may

offset one another. Overall, I find mean days away from work increased for claims having incentivized injuries after the bonus was in place, from 12.5 days in POST1 to 15.6 days in POST2, and this change is statistically significant. To ascertain how this increase was driven by changes across the distribution of claim duration, I compare the distributions of days away from work in POST1 and POST2. With the exception of the right hand tail of the distribution, the implementation of the bonus payment did not appear to induce any further change in days away from work. The 99th percentile of days away from work, however, increased enormously, from 220 days in POST1 to 343 days in POST2. This is consistent with case managers increasing duration for severe claims in order to have the claims excluded from the bonus payment.[69]

To illustrate that these changes were timed with the bonus payment's implementation, Figures 3-4a-3-4d depict changes over time for selected quantiles of the weighted distribution of claim duration, separately for claims having incentivized and non-incentivized injuries.[70] The first vertical line marks the quarter when the TCMs began managing claims (1997, Q1), and the second vertical line marks the quarter when the bonus payment was implemented (1999, Q2). Before the TCMs were in place, the 85th percentile for claims with incentivized injuries ranged from seven to 13 days away from work, and the corresponding percentile for claims with non-incentivized injuries

[69] Although 15 months corresponds to approximately 457 days, and the increase in days away from work at the 99th percentile still has claimants returning to work before 15 months pass, this increase is consistent with the predicted strategic behavior of TCMs. The bonus payment is paid quarterly and only includes claims that returned to work before the a new calendar quarter begins. Once a claim has missed five consecutive calendar quarters, the spell away from work is never included in the bonus payment calculation (the 15-month provision). It follows that once a spell extends more than four calendar quarters, the spell will only count against the TCM in the calculation of one bonus payment. The increase from 220 days to 343 days pushes a claimant from two quarters away from work to nearly four quarters. Instead of being included in three bonus payment calculations, this spell is only included twice.

[70] Results are weighted by the inverse of the predicted probability a claim has valid return-to-work information.

was between five and six days away from work. Once the TCMs began to manage claims, days away from work fell slightly for all claims. After the bonus was put in place, there was an additional (slight) decline at the 85th percentile of days away from work for claims having incentivized injuries. Similar trends arose at the 90th percentile, and there was little change in duration among claims at the 95th percentile—and possibly a slight increase after the bonus is in place. The very top of the distribution, the 99th percentile, follows a totally different pattern. Once the bonus payment was introduced, the duration of claims with incentivized injuries increased dramatically.

As shown in Table 3-3, claims having incentivized injuries also experienced a slightly larger and statistically significant increase in the share of claims spanning more than 15 months (.0054 to .0085) whereas the change among claims with non-incentivized injuries was more modest (.00028 to .00046). One mechanism TCMs might use to increase duration is enrollment in vocational rehabilitation. Claims having incentivized injuries experienced a large, statistically significant increase in the share of claims receiving vocational rehabilitation (.0109 to .0164), whereas the increase for claims having non-incentivized injuries was smaller and not statistically significant (.0011 to .0014). As shown in Figure 3-5, this increase in vocational rehabilitation was timed with the policy change.

The descriptive statistics suggest that increases in duration were concentrated among the top one percent of all claims. Although this is a small share of all claims, these injuries comprise a substantial share of WC costs, as shown in Table 3-4. Column (1) details the days away from work in the PRE period for non-incentivized injuries from the 80th through the 99th percentile. In column (2), I present the share of cash benefits

accrued by injured workers at or above the corresponding percentile. For example, in the PRE period, 99 percent of cash benefits were conferred to injured workers above the 80th percentile in the distribution of claim duration (four days).[71] Approximately 72 percent of all cash benefits were paid to injured workers at or above the 98th percentile, and over half of all cash benefits accrued to injured workers at or above the 99th percentile. I observe a similar pattern among incentivized injuries. Claimants in the top percentile received 42 percent of all cash benefits. Although the increase in duration was concentrated among a small share of claimants, these individuals comprise a disproportionate share of program costs.

These changes observed in the descriptive data are consistent with the policy reforms having a measurable effect. However, it is also possible the observed patterns are caused by changes in the composition of injured workers. In Tables 3-5 and 3-6 I examine how the composition of injured workers changed over time. Table 3-5 lists the most common injuries by incentivized status.[72] The share of claimants with the two most common injuries did not change substantially over time. Roughly 12 percent of all claimants having a non-incentivized injury were diagnosed with an open wound of the forearm, and 18 percent of claims having an incentivized injury were diagnosed with an open wound of the finger. However, for many diagnoses, the changes over time are statistically significant. Therefore, it will be important to carefully control for the composition of injuries when analyzing the impact of the policy changes on claim duration.

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[71] Some injured workers do not miss any work immediately after their injury but are forced to miss at least one day after a week has passed (e.g., for doctor's appointments). Since more than one week has passed, the worker receives cash benefits for that day. This explains why less than 100 percent of cash benefits accrue above the 80th percentile.

[72] The composition of injuries over time is sensitive to weighting.

In Table 3-6, I present summary statistics for the demographic and job characteristics that are related to the ease with which a worker will be able to heal and return to work.[73] For example, the WC literature has established that women return to work more slowly than men and older workers return to work more slowly than younger workers (e.g., Krueger, 1991; Ruser et al., 2004). Some modest changes over time in the composition of injured workers suggest some of the observed increases in duration might have been driven by sample composition changes. In the PRE period, over 70 percent of all claimants were male, approximately half were married, and the average age was about 33. Consistent with general labor market trends, in POST2 women comprised a larger share of injured workers and the claimants were slightly older. These changes confirm that it is particularly important to control for demographic characteristics to ensure that any observed increase in days away from work is not simply a result of these sample composition changes or the differences between the two groups of injuries. Some jobs are better able to accommodate injured workers than others. Therefore, it is also important to control for the claimant's occupation. As shown in the bottom of Table 3-6, most injured workers are service workers, production workers, or laborers. In the next section, I turn to a formal analysis of claim duration as a function of the policy changes, controlling for a worker's injury, demographic, and job characteristics.

3.5 Measuring the Impact of the Return-to-Work Bonus Payment

The basic empirical strategy I employ compares the change in days away from work arising from the implementation of the bonus payment for claims having an incentivized injury (treatment group) with the change in duration over the same period for claims not

[73] Descriptive statistics for demographic and job characteristics are not sensitive to weighting.

having an incentivized injury (comparison group). I include claims not having incentivized injuries to capture any underlying trends over time in days away from work so that I can better isolate the impact of the bonus payment. The identifying assumption that will lead me to draw a correct causal interpretation of the results is that any trend influencing claim duration has the same effect on days away from work for claims having incentivized and non-incentivized injuries. This is a nontrivial assumption because different types of injuries are granted incentivized or non-incentivized status, and mean duration is different for the two groups. I address this issue in two ways. First, I can quantify whether or not the comparison group reasonably controls for other trends by testing whether the two groups receive similar treatment in the period before the bonus payment was in place. Between 1997 and the bonus payment's implementation in 1999, the TCMs had no reason to treat workers with the two classes of injuries any differently from one another. Therefore, I test whether or not the two groups received equal treatment during this period. Second, I examine the main results within four samples of more comparable injuries.

I investigate whether or not the observed changes in mean days away from work persist once I control for injury, demographic, and job characteristics. Using Ordinary Least Squares, I estimate days away from work using the following specification:

(1) $$DAYS_{i,j,t}=\lambda_0+ \lambda_1 POST1_t+ \lambda_2 POST2_t+\lambda_3 POST1_t*INCENT_j+\lambda_4 POST2_t*INCENT_j+\beta X_i+\gamma_j+\eta_t+ \mu_{i,j,t}$$

where *i* references the claimant, *j* the diagnosis, and *t* the year of injury.[74] Days away from work is a function of having an injury which will qualify for the bonus, captured in the vector of diagnosis code fixed effects γ; an indicator for the period when the TCMs are in place but the bonus is not, *POST1*; and an indicator for the second policy change when the TCM and the bonus are both in place, *POST2*.[75] Let *INCENT* identify those claims assigned one of the 266 incentivized codes.[76] The interactions between *POST1*INCENT* and *POST2*INCENT* are the main variables of interest. The vector *X* includes job and demographic characteristics, as well as month indicators to control for the seasonality of workplace injuries. The vector η contains year fixed effects.[77] Standard errors are clustered by injury code.

The estimates for λ_1 and λ_2 capture the impact of the TCMs in *POST1* and *POST2* on all claims, and I expect the coefficients will be zero or negative. The policy changes are only predicted to impact claims with non-incentivized injuries through infrastructure changes, such as the TCM insurance cards. These infrastructure changes are likely to have a negative effect on the duration of claims having minor injuries but no effect among particularly severe injuries. The coefficients λ_3 and λ_4 capture any average differential impact of the TCMs on claims having incentivized injuries. Since the TCMs were in place for two years before the bonus was implemented, I can check the assumption that the comparison group reasonably controls for other trends by examining claim duration for the two groups during this intermediate period. A priori, the

[74] The main qualitative results are confirmed using a Cox proportional hazard analysis. To address the skewness of the data, I also estimated negative binomial models. The general conclusions of the paper are upheld in these models, even on the sample of all injuries. Results available upon request.
[75] In this case, the left out category is *PRE*, the period before the TCMs are in place (1/95-2/97).
[76] The variable *INCENT* is not included by itself because it is perfectly correlated with γ.
[77] The job characteristics are 1-digit industry, 1-digit occupation, the employer's experience rate in the year of injury, and indicators for whether or not the employer is large or risky enough to be experience rated.

introduction of the TCMs, without the bonus in place, is not predicted to have a differential impact on treatment group claims. If this is the case, the coefficient on *POST1*INCENT* will be zero. In general, if the bonus induces treatment group claimants to return to work more quickly (slowly) on average, the coefficient on *POST2*INCENT* will be negative (positive). In the full sample comprised of injuries of all levels of severity, the expected sign of the coefficient on *POST2*INCENT* is theoretically ambiguous. The TCMs are expected to decrease duration for claims having moderately severe injuries and increase duration for some claims having severe injuries.

Results for the full sample are presented in Table 3-7, column (1). As expected, the coefficients on *POST1* and *POST2* are negative and small in magnitude (-.18 and -.93, respectively), and they are not statistically significant. This implies no aggregate impact of the TCMs on all claims. The TCM does not appear to have a differential effect on incentivized injuries, as captured by *POST1*INCENT* and *POST2*INCENT*. As expected, the coefficient on *POST1*INCENT* is -.60 and not statistically significant, suggesting claims having non-incentivized injuries are a reasonable comparison group. The coefficient on *POST2*INCENT* is 1.25 and is also not statistically significant.

To address concerns that differences in the set of injuries comprising the incentivized and non-incentivized groups drive the findings, columns (2) through (5) contain results for subsamples with more homogenous injuries. In column (2), only those five-digit diagnosis codes that aggregate up to a three-digit ICD-9 code having both incentivized and non-incentivized injuries are included. For example, "847, Sprain and strain of back," is comprised of both incentivized (847.20) and non-incentivized (847.10) diagnosis codes. Therefore, all sprains and strains of the back are included in this

subsample whereas cases of carpal tunnel syndrome are excluded because all corresponding 5-digit codes are incentivized. Columns (3) through (5) further restrict the sample to three of the most common types of injuries: back sprains, bruises, and cuts. As in the full sample, in every case, the coefficients on *POST1* and *POST2* are small in magnitude and not statistically significant. Estimates for *POST1* fall between -2.6 and .32, and estimates for *POST2* fall between -2.3 and -.04. In only two of the samples does the TCM appear to have a differential effect on incentivized injuries, as captured by the interaction terms *POST1*INCENT* and *POST2*INCENT*. In column (3), the coefficient on *POST1*INCENT* is –2.95, and statistically significant, implying case managers reduce duration for incentivized back injuries by nearly three more days than for non-incentivized back injuries. The sample of back sprains experiences large changes in composition over this time period, and this change is concentrated among incentivized injuries.[78] Although this implies back sprains may not be the best group of injuries within which to quantify the policy change, I include this sample in the analysis because they are common, costly workplace injuries. Injured workers suffering back injuries comprise 30 percent of all cash benefit claims and receive over 50 percent of cash benefits paid. The coefficient on *POST2*INCENT* is positive and significant for both back sprains (1.865) and bruises (.687), but these increases are small in magnitude and sensitive to outliers. In general, the other coefficients are of the expected sign. Claim

[78] In Appendix C, I estimate the probability a claim receives cash benefits as a function of the policy change, controlling carefully for injury, job, and demographic characteristics. The sample of back sprains is the only group of injuries for which there are systematic changes in the probability of receiving cash benefits, and incentivized back sprains experience a persistent decline in the probability of receiving cash benefits.

duration is shorter for men and longer for older workers.[79] Managers, service workers, and support personnel return to work more quickly than laborers.[80]

3.5.1 Heterogeneous Effects

Results from the above specification tell no consistent story of the impact of the TCMs or the bonus payment on days away from work. However, the structure of the bonus payment suggests heterogeneous responses that may offset one another. Therefore, to quantify the effect of these policy reforms on claim duration, I must allow the impact to vary for claims of different levels of severity. Following Meyer et al. (1995), I examine these differential responses using quantile regression estimates analogous to equation (1). Quantile regression allows me to estimate the impact of the bonus payment at different points in the response distribution, conditional on the covariates. There is so little variation in days away from work at the bottom of the distribution of claim duration (among medical only claims of one week or less) that it is only interesting (and feasible) to examine the results across quantiles for cash benefit claims. If the bonus induces TCMs to attempt to reduce duration for moderately severe injuries, then the coefficient on *POST2*INCENT* will be negative for the lower quantiles. Once duration exceeds the threshold beyond which it benefits the TCM for the claim to extend more than 15 months, the bonus should lead to either no change or increased duration. Thus, I expect the coefficient on *POST2*INCENT* will be large and positive for the higher quantiles.

[79] Married workers return to work more slowly than single workers. This finding is consistent with much of the previous literature (e.g., Krueger (1991)) and may reflect a second earner's ability to smooth income.
[80] Following Evans and Owens (forthcoming), I also control for pre period trends in duration by allowing for separate linear trends for the deciles of the distribution of pre period duration. I only include those injuries falling in deciles with both treatment and comparison group claims. Restricting the sample in this way does not change the qualitative results for days away from work, nor do the conclusions change when I allow for different time trends for each bin. Results available upon request.

The key results from quantile regression are shown in Figures 3-6a and 3-6b. In Figure 3-6a, the solid line depicts the coefficient on *POST1*INCENT* from 20 quantile regressions on the sample of cash benefit claims, from the 5th through the 95th, and also including the 99th. The outer dashed lines bound the 90 percent confidence interval. The change in days away from work is always close to zero and is never statistically significant. The results are quite different in the analogous plot for the coefficient on *POST2*INCENT*, as shown in Figure 3-6b. Below the 30th percentile, the coefficient is negative but not statistically significantly different than zero. Although this result does not reflect the predicted decline in duration for moderately severe claims, it suggests there was no change in duration for these claims. From the 30th to the 80th percentiles, the coefficient is positive, between .13 and 7.34, but still not statistically significantly different than zero. Above the 80th percentile, the coefficient is positive and statistically significant, between 15 and 105 days. These findings are consistent with the bonus increasing duration for claims that exceed the 15-month threshold. However, these estimates do not allow me to pinpoint whether or not the observed increase reflects this strategic behavior because quantile regression describes changes to the response distribution, conditional on all of the covariates.[81]

To further quantify the impact of the policy changes, I examine changes in duration separately for medical only and cash benefit claims. I split the sample in this way for two reasons. First, the policy changes are predicted to have different impacts on these two groups of claims. Since TCMs do not learn of claims until an average of one week has passed, the only impact on medical only claims will be changes in

[81] It is not so easy to determine what level of duration is represented by the 95th percentile, conditional on all of these covariates. In addition to controls for demographic, employer, and job characteristics, each regression includes injury fixed effects.

infrastructure. In contrast, TCMs are predicted to respond to the bonus payment and impact the duration of cash benefit claims. By splitting these two groups, I can separate the impact of infrastructure changes from the bonus payment. Second, it is of particular interest to isolate the impact on cash benefit claims because they drive WC costs and because most WC research exclusively looks at this subset of claims (e.g., Krueger, 1991; Meyer et al., 1995). Although fewer than 20 percent of injured workers receive cash benefits, these claims comprise over 95 percent of total costs.

3.5.2 Minor Claims

I examine the impact of the TCM and bonus payment on minor, medical only claims using the specification given in equation (1) for the sample of medical only claims. Infrastructure changes are predicted to reduce duration for all claims, so I expect to find a negative coefficient estimate on both *POST1* and *POST2*. Since most claims are not filed with the TCMs until one week passes, I expect to find no differential impact for incentivized injuries. The results from this exercise are shown in Table 3-8. The coefficients on *POST1* and *POST2* are statistically significant, near -.3, suggesting the TCMs reduced duration by about one-third of a day for all minor claims. This interpretation assumes that the TCMs were the only change to duration over this time period. In general, the coefficients on the interaction terms *POST1*INCENT* and *POST2*INCENT* are small in magnitude and not statistically significant. This is expected because medical only claimants return to work before the claim is filed, so TCMs cannot differentiate between the two groups of claims. The one exception is found in the sample of cuts. However, the conclusion that TCMs treat all minor claims in the

same way, regardless of incentivized status is upheld because although the coefficients are statistically significant, they are not economically meaningful. The coefficient estimates imply workers return to their jobs between .04 and .13 days sooner.

3.5.3 Severe Claims

Next, I estimate days away from work as a function of the policy changes on the sample of cash benefit claims. In the absence of the bonus payment, only infrastructure changes are predicted to impact duration and these changes are expected among minor claims. Once the bonus is in place, the TCMs are expected to attempt to reduce claim duration for each claim with an incentivized injury until the claim exceeds the threshold at which point duration is predicted to increase. These regressions assume a common effect of the bonus payment on cash benefit claims of all levels of severity, captured by the sign of the coefficient on *POST2*INCENT*. The expected sign is theoretically ambiguous because the TCMs are predicted to reduce duration for some cash benefit claims and increase duration for others.

These results are presented in Table 3-9. There is variation in mean days away from work among the different samples. Clearly, the cuts and bruises that receive cash benefits are less severe than the average back sprain eligible for cash benefits. In every column, the coefficients on *POST1* and *POST2* are not statistically significant, suggesting there is no general effect of the TCMs on cash benefit claims. In column (1), using the entire stock of injuries, the coefficient on *POST1*INCENT* is 7.15 and statistically significant. This coefficient confirms that the two groups of injuries did not receive the same treatment before the bonus was in place. When the sample is restricted to more

similar groups of injuries, as in columns (2) through (5), this coefficient estimate is always small in magnitude and never significant. Therefore, within samples of common injuries, the TCMs do not treat claimants having incentivized injuries any differently before the bonus is in place.

In general, the coefficient on *POST2*INCENT* is large, statistically significant, and an order of magnitude larger than even the statistically significant *POST1*INCENT* effect. In the common injury sample, the coefficient estimate for *POST2*INCENT* is 19.2, implying the implementation of the bonus payment increased duration for incentivized injuries by nearly three weeks.[82]

The exception is found in the sample of cuts, a group of injuries expected to be unresponsive to TCM efforts. Among cuts, the estimates for the policy variables are never statistically significant, suggesting the policies had no effect on claimants with that group of injuries. This result is consistent with the previous literature which has found that claimants suffering "traumatic" injuries, such as cuts or fractured legs, are considered less responsive to changing benefit levels than claimants with soft tissue injuries (e.g., Biddle and Roberts, 2003; Biddle, 2001; Ruser, 1998; and Neuhauser and Raphael, 2004). If claimants are less sensitive to benefit levels, they will also likely be less responsive to TCM intervention.

The finding of an increase in days away from work among incentivized cash benefit injuries is consistent with TCMs increasing duration for particularly severe claims with incentivized injuries to maximize the bonus payment. However, this finding does

[82] Over time, claims are less likely to be awarded cash benefits. If the least severe claims no longer receive cash benefits in POST1 or POST2, these results are biased away from zero. This is especially problematic if the probability of receiving cash benefits changes differentially for incentivized injuries. In Appendix C, I present results from a linear probability model for the probability of cash benefit receipt. No pattern emerges, but these results suggest the cleanest test is among common injuries.

not show directly that these increases correspond to claims becoming longer than 15 months.

3.5.4 Strategic Behavior to Increase Duration

To investigate whether or not claims are strategically getting longer so that they are excluded from the computation of average days away from work, I estimate the following linear probability model

$$(2)\ GT15s_{i,j,t}=\theta_0+\theta_1 POST1_t+\theta_2 POST2_t+\theta_3 POST1_t*INCENT_j+$$
$$\theta_4 POST2_t*INCENT_j+\beta X_i+\gamma_j+\eta_t+\nu_{i,j,t}$$

where *GT15* is a dummy variable that equals one if the spell spans more than 15 months.

If the increase in duration corresponds to strategic behavior to maximize the bonus payment, then I expect the coefficient estimate for *POST2*INCENT* to be positive and the coefficients on the other policy variables to equal zero. In Table 3-10, I present these results for three samples: all injuries, the common injury sample, and back sprains, and results from probit models are qualitatively similar. Fewer than one-tenth of one percent of claimants suffering from cuts or bruises have claims extending more than 15 months, so those samples are not included in this analysis. The coefficients on *POST1* and *POST2* are small in magnitude and never statistically significant, implying the TCMs did not increase claims beyond 15 months indiscriminately. The coefficient on *POST1*INCENT* is always small in magnitude and only statistically significant in the case of back injuries, -.0011. This estimate implies once the TCMs are in place, workers having incentivized back injuries were .11 percentage points *less* likely to have a claim

exceed 15 months. From a base of 1.1 percent of the sample having claims so long they exceed 15 months, this implies a ten percent drop in the probability a claim exceeds 15 months. This could mean TCMs successfully reduce moral hazard among injured workers with back sprains in the period before the bonus is in place, or the drop may merely reflect the sample composition changes among back sprains.

In each case, the coefficient on *POST2*INCENT* is positive and significant. For example, in the sample of common injuries in column (2), the estimate is .002. This implies that injured workers diagnosed with an incentivized injury are .2 percentage points, or 40 percent, more likely to be out of work for more than 15 months once the bonus is in place. This implies TCMs engaged in strategic behavior to maximize the bonus payment.[83]

Although no single specification allows me to quantify the TCM response across the entire distribution of claim duration, together these estimates describe the impact of the bonus on claim duration for workers with claims of different severity. It appears that TCMs are acting in ways consistent with maximizing the bonus payment. Thus, it is not surprising that since the fourth quarter of 2001, over 75 percent of all TCMs have received the full bonus payment each quarter. However, these results also imply that TCMs are behaving in ways not envisioned by the state when the bonus was constructed. The results are consistent with case managers increasing claim duration for severe claims having incentivized injuries, so that the claims extend long enough to be excluded from the bonus payment. These results do not offer explanations for the mechanism used to

[83] Estimation of a Cox proportional hazard model with time varying covariates for incentivized, cash benefit injuries shows that once the bonus is in place, there is a decline in the probability a worker returns to work the week before hitting the 15-month threshold.

impact duration. To address this, in the next section I explore two potential mechanisms through which case managers might be able to impact duration.

3.6 Exploring How the TCMs Achieve Results

3.6.1 Receipt of Vocational Rehabilitation Benefits

One method case managers might use to extend claim duration past 15 months, so that the claim will no longer be included in the bonus payment calculation, is to enroll claimants in vocational rehabilitation programs. Vocational rehabilitation consists of job training and a formal job search in preparation for gainful employment in a new position. In Ohio, injured workers continue to receive WC cash benefits while enrolled. In addition, participation in vocational rehabilitation does not count as return to work for the purposes of the bonus payment while the benefits paid to injured workers and the cost of the program are borne by the state instead of the employer. Claimants may be eligible for vocational rehabilitation as soon as the injury occurs but tend to enroll in the rehabilitation program after an average of ten months. These programs last for an average of 6.5 months. Thus, it is indeed workers near 15 months who receive vocational rehabilitation, with the programs lasting long enough to keep claimants away from work past 15 months.[84]

The vocational rehabilitation must begin before the worker has missed 15 months of work for the rehabilitation program to be an effective mechanism for TCMs to strategically increase claim duration in response to the incentive payment. Therefore, I estimate a linear probability model similar to equation (2), where now the dependent

[84] Workers suffering soft tissue injuries or back injuries are those most likely to receive vocational rehabilitation.

variable, *VOCLT15*, equals one if the injured worker receives vocational rehabilitation and the program begins before the worker misses 15 months of work. If the TCMs use vocational rehabilitation to strategically increase claim duration, then the coefficient estimate on *POST2*INCENT* will be positive and statistically significant, and the coefficient estimates on the other policy variables will be zero. Results from this regression are shown in Panel A of Table 3-11. Column (2) contains results for the sample of all common injuries. The coefficient on *POST1*INCENT* is small (.001) and not statistically significant, and the coefficient on *POST2*INCENT* is four times as large (.004) and statistically significant. Once the TCM and the bonus were in place, workers with incentivized injuries became .4 percentage points more likely to receive vocational rehabilitation, an increase of over 50 percent. This is consistent with the hypothesis that case managers use enrollment in vocational rehabilitation programs to increase days away from work for particularly severe claims. Results from the sample of back sprains and the full sample are qualitatively similar and point to between a 50 and 90 percent increase in the probability an injured worker receives vocational rehabilitation benefits. These findings lend support for one mechanism case managers may use to extend claim duration, thereby corroborating the estimated increase in duration for claims having severe incentivized injuries.

I interpret the results in Panel A as evidence case managers use enrollment in vocational rehabilitation to increase duration for claims so that they last longer than 15 months. One concern with this interpretation is that claims having incentivized injuries may be more attractive candidates for vocational rehabilitation, and the coefficient on *POST2*INCENT* merely captures the increased use of vocational rehabilitation over time.

I can rule out this explanation by examining whether claims having incentivized injuries have higher rates of participation in vocational rehabilitation when the programs begin *after* 15 months have passed. Claims lasting longer than 15 months are automatically excluded from the bonus calculation, so the case managers have no incentive to further increase duration for these claimants.[85] I formally test this hypothesis by re-estimating equation (2) using the dependent variable *VOCGT15*, which equals one if the individual receives vocational rehabilitation benefits beginning *after* the worker misses at least 15 months. I present the coefficient estimates in Panel B; few coefficients are statistically significant, and no clear pattern emerges. Therefore, in response to the bonus payment, TCMs appear to be strategically increasing duration for claims having incentivized injuries so that the claimant misses more than 15 months of work and the claim is excluded from the calculation of average days away from work. Furthermore, I identify one tool which TCMs use to increase duration; enrolling workers in lengthy vocational rehabilitation programs.

3.6.2 Ignoring Claims

In the discussion of the expected effects of the TCMs on claim duration, I identify two possible approaches TCMs might take to manage claims having severe incentivized injuries. The TCM might increase duration for some of these claims by enrolling injured workers in vocational rehabilitation. Some claims will remain away from work longer than 15 months in the absence of any intervention. The TCM might enroll these workers

[85] Of course, TCMs may be able to increase duration with the promise of vocational rehabilitation beginning after 15 months. In results not shown, I confirm that the main qualitative result holds when the dependent variable is any vocational rehabilitation receipt, whether or not it was received before or after 15 months.

in vocational rehabilitation to ensure they miss more than 15 months of work, or the TCM may simply ignore them. Since it is difficult to identify which claims will remain away from work past 15 months and many TCMs have an additional financial incentive to enroll injured workers in vocational rehabilitation programs, it is an empirical question whether or not TCMs enroll all claims having severe incentivized injuries in vocational rehabilitation. To test whether TCMs ignore any severe claims, I first quantify whether there are any injured workers with severe injuries *not* enrolled in vocational rehabilitation. Next, I examine the impact of the bonus payment on these ignored claimants.

Clearly, case managers have interacted with those injured workers who receive vocational rehabilitation benefits. Therefore, to focus attention on claims that managers may have "ignored", I restrict the sample to those injured workers who do not participate in those rehabilitation programs. As shown in Table 3-12, even when I exclude vocational rehabilitation participants, some injured workers have spells that last longer than 15 months. Approximately .3 percent of these claimants miss more than 15 months of work (.2 percent of the common injury sample and .5 percent of the back sprain sample). Therefore, there are some severe claims that do not receive vocational rehabilitation, suggesting some severe claims may be ignored.

If case managers respond to the bonus payment by ignoring claims, then "ignored" injured workers will remain away from work the same amount of time in both PRE and POST2. If this is the case, I will find no effect of the bonus payment on the probability a claim having an incentivized injury lasts longer than 15 months. In Panel C, I present estimates from a linear probability model predicting whether a claim will span

more than 15 months of work (equation (2)) for the sample of claims that do not receive vocational rehabilitation benefits. As expected, the coefficients are small in magnitude and rarely statistically significantly different than zero. For example, in the common injury sample in column (2), the coefficient on *POST2*INCENT* is -.0005 and not statistically significant. This finding lends support for case managers ignoring those claimants that will remain away from work for more than 15 months in the absence of any intervention.

3.7 Discussion

3.7.1 Financial Impact of the Policy Changes

Although the following calculations are only approximations based on several assumptions, they provide a sense of the magnitude of the costs and benefits of these policy changes. I find that even without the bonus payment, the TCMs reduced claim duration for minor claims by an average of one-third of a day of work (see Table 3-8). However, in the absence of the bonus payment, the TCMs had no impact on any other group of claims (see Tables 3-7 and 3-9). Getting medical only claimants back to work one-third of a day sooner does not change the amount of cash benefits paid. However, when medical only claimants return to their jobs sooner, worker productivity increases. Approximately 70,000 injured workers received medical only benefits in 2002.[86] Under the assumption that a worker's productivity equals his or her daily wage, then the productivity gained for each additional day worked averaged $88 per day in 2002,

[86] These are weighted totals, not the actual sample size.

generating approximately $1.8 million in productivity gains.[87] This is a lower bound of the policy's effect because TCMs were likely paid less than what it would have cost the state to manage the same cases. In 2002, the state paid TCMs $100 million to manage all claims, so even small efficiency improvements by TCMs correspond to millions of dollars in additional savings to the state.

The bonus payment increased duration for cash benefit claimants diagnosed with incentivized injuries by an average of 20 days (see Table 3-9) and had no impact on any other group of claims (see Tables 3-7 and 3-8). Nearly 9,000 cash benefit claimants had incentivized injuries in 2002. This corresponds to an increase of approximately 180,000 days away from work. The cost of these additional days away from work was at least the amount of the cash payments to workers, which averaged $59 per day, for a total of $10.6 million. These missed days of work also generated productivity losses totaling $15.8 million. Thus, I estimate the additional cash payments and lost productivity may have cost Ohio approximately $26.4 million per year. Estimated costs to the state are even larger when I also consider the mechanism TCMs use to increase duration, enrollment in vocational rehabilitation. I estimate that 265 individuals received rehabilitation because of the bonus payment, and the average cost of the program was close to $50,000 per participant.[88] This corresponds to $13.0 million in additional costs for vocational rehabilitation.[89] Thus, when I include the costs of vocational rehabilitation, I estimate the bonus payment may cost the state up to $39.4 million per year.

[87] U.S. Chamber of Commerce, 2003.
[88] In 2002, the state paid $55.3 million to vocational rehabilitation providers, and 1,125 individuals received vocational rehabilitation.
[89] Although the rehabilitation programs may make workers somewhat more productive than they otherwise would have been, any gains in productivity are unlikely to exceed the additional program costs.

3.7.2 Conclusion

In this chapter, I examine the impact of a bonus payment intended to reduce claim duration among Ohio WC recipients and find evidence of costly unintended consequences. As more government programs incorporate performance-based incentives, understanding effective contracts becomes even more important. The lessons of this case study may generalize to public WC programs in other states, to private WC insurers or employers wishing to contract out WC case management services, and possibly even to other public programs. In the late 1990s, Ohio contracted out WC case management services to TCMs and incorporated a bonus payment intended to reward TCMs for expediting return-to-work. The incentives were such that one would expect heterogeneous effects along the timeline of a claim: no impact for claims before the TCM learns of the injury, efforts to reduce days away from work as soon as the TCM learns of the claim, and an increase in days away from work for claims near 15 months, at which point claims are excluded from the bonus payment. My results show that the bonus impacts days away from work, and the changes correspond to these predictions. The strongest evidence suggests the bonus payment induces TCMs to increase days away from work for claims having incentivized injuries. I show that the TCMs may use enrollment in vocational rehabilitation programs to extend the length of some claims, and the net effect is an increase in overall days away from work. I estimate these additional days away from work may cost the state $26.4 million in additional cash benefits and lost productivity per year.

The conclusions of this paper are consistent with much of the previous empirical literature studying government contracts (e.g., Duggan, 2004; Heckman et al., 2002). As

in these other studies, I find that contractors respond to the incentives in the contract, sometimes in ways inconsistent with the program goals. In the case of Ohio WC, the state may choose to restructure the bonus payment to reduce the incentive to increase duration. More generally, this should caution public entities to carefully anticipate strategic behavior when crafting the structure of performance-based incentives.

Tables for Chapter 3

Table 3-1: Most Common Injuries by Eligibility for Bonus Payment

Non-Incentivized Injuries	Incentivized Injuries
Open wound, elbow/forearm/wrist (881.00)	Open wound of finger (883.00)
Sprain and strain of back, thoracic (847.10)	Sprain and strain of back, lumbar (847.20)
Contusion, chest wall (922.10)	Open wound of hand (882.00)
Open wound of scalp (873.00)	Sprain and strain of lower back (846.00)
Open wound of forehead (873.42)	Superficial injury of cornea (918.10)
Toxic effect of venom (989.50)	Sprain and strain of ankle (845.00)
Contusion, knee and lower leg (924.10)	Sprain and strain of neck (847.00)
Sprain and strain, other (848.80)	Foreign body in eye, cornea (930.00)
Toxic effect of gas/vapor (987.90)	Contusion, finger (923.30)
Open wound of hip/thigh (890.00)	Sprain and strain, shoulder/upper arm (840.90)
Sprain and strain, pelvis (848.50)	Sprain and strain of wrist (842.00)
Conjunctivitis (372.30)	Contusion, wrist and hand (923.20)
Broken tooth (873.63)	Contusion, face, scalp, and neck (920.00)
Dermatitis (692.90)	Sprain and strain, knee/leg (844.90)
Superficial keratitis (370.24)	Contusion, knee (924.11)
Open wound of face (873.40)	Contusion, foot (924.20)
Contusion, hip and thigh (924.00)	Foreign body in eye, other (930.90)
Burn, eye (940.90)	Open wound of knee, leg, and thigh (891.00)
Sprain and strain, ribs (848.30)	Sprain and strain, hand (842.10)
Electrocution (994.80)	Contusion, elbow (923.11)

Source: Author's calculations using Ohio administrative claims data.

Table 3-2: Sample Composition

	Full Sample	Medical Only	Cash Benefit
Number of claims	1,609,252	1,309,466	299,786
First claim for each injured worker[a]	1,092,981	885,838	207,143
Claim has valid diagnosis information	1,089,794	885,090	204,704
Claim was not awarded death benefit within three years of injury	1,089,733	885,090	204,643
Claim is not missing demographic, job, employer, or TCM information	963,675	776,003	187,672
Claimant did not receive permanent disability benefits or a lump sum benefit within three years of injury	897,880	775,062	122,818
Claimant between ages 18 and 64	869,637	750,440	119,197
Claim has valid return-to-work information[b]	547,096	480,525	66,571
Diagnosis has claims with information each period[c]	530,316	465,844	64,472
Diagnosis has at least 100 claims in each period	491,533	437,814	53,719
Common injury sample	130,291	116,142	14,149
Back injury sample	78,701	61,918	16,783
Sample of cuts, excluding head injuries and complications	120,939	118,239	2,700
Sample of bruises/contusions	87,638	83,586	4,052

[a]Workers are identified by employer, date of birth, and gender

[b]To have valid return to work information, cash benefit recipients must have checks itemized with one of three types of benefits (Temporary Total Disability benefit receipt, Living Maintenance (paid while worker is in Vocational Rehabilitation) or Non-Working Wage Loss) and the benefits must be paid within the same quarter the worker was injured or within one week of injury (if they begin in a subsequent quarter). Medical only recipients must (1) have a valid return to work date and (2) this return to work date must fall within eight days of the injury.

[c]If diagnosis has both medical only and cash benefit claims, both types of claims must be represented in each period to meet this criteria

Table 3-3: Characterizing Claim Duration

	Non-Incentivized Injuries			Incentivized Injuries			
	PRE	POST1	POST2	PRE	POST1	POST2	PRE_{non}=PRE_{inc}
Full Sample							t-statistic
Mean Days Away from Work	4.421 (19.223)	3.846† (13.230)	3.988 (18.796)	14.094 (62.807)	12.542† (61.669)	15.562† (80.240)	-18.68
Distribution of Days Away from Work (Percentiles)							
1st	1	1	1	1	1	1	
5th	1	1	1	1	1	1	
25th	1	1	1	2	1	1	
50th	2	2	2	2	2	2	
75th	4	3	3	5	4	4	
95th	9	9	8	52	44	48	
99th	42	35	37	255	220	343	
Share of claims> 15 months	.00048	.00028	.00046†	.0056	.0054	.0085†	-8.34
Share Receive Voc. Rehab.	.0005	.0011	.0014	.0082	.0109†	.0164†	-10.41
N	14,906	11,550	32,800	109,187	85,978	237,112	

All values are weighted by the inverse probability a claim has missing return to work information.
† Indicates mean statistically significantly different than corresponding mean in previous period (at the ten percent level).

Table 3-3 (continued): Characterizing Claim Duration

	Non-Incentivized Injuries			Incentivized Injuries			
	PRE	POST1	POST2	PRE	POST1	POST2	$PRE_{non}=PRE_{inc}$
Common Injury Sample							
Mean Days Away from Work	5.317 (23.862)	4.415† (14.595)	4.400 (19.341)	13.971 (58.654)	11.575† (51.081)	13.800† (70.116)	-12.06
Share of claims> 15 months	.00086	.00030	.00057	.00536	.00437	.00693†	-5.04
Share Receive Voc. Rehab.	.0007	.0020†	.0022	.0081	.0101†	.0141†	-6.80
N	6,988	5,480	15,650	25,566	20,054	56,553	
Sample of Back Injuries							
Mean Days Away from Work	9.376 (37.594)	6.839 (22.633)	7.134 (32.599)	25.221 (83.533)	19.706† (72.200)	24.671† (98.593)	-7.96
Share of claims> 15 months	.0028	.0010	.0016	.0114	.0085†	.0140†	-3.37
Share Receive Voc. Rehab.	.0027	.0068†	.0065	.0181	.0211†	.0289†	-4.85
N	1,796	1,582	4,542	18,216	14,854	37,711	
Sample of Bruises							
Mean Days Away from Work	5.423 (22.356)	4.663 (13.030)	4.420 (12.376)	5.109 (21.142)	4.437† (21.422)	4.882† (27.950)	.67
Share of claims> 15 months	.0004	0	.0003	.0005	.0006	.0010	-.25
Share Receive Voc. Rehab.	0	0	.0006	.0008	.0009	.0020†	-1.37
N	2,331	1,811	5,177	18,605	15,530	44,184	
Sample of Cuts							
Mean Days Away from Work	2.602 (9.258)	2.508 (5.982)	2.240† (5.238)	2.904 (9.709)	2.650† (7.557)	2.571 (8.398)	-1.46
Share of claims> 15 months	0	0	0	.0001	0	.0001	-.45
Share Receive Voc. Rehab.	0	0	.0007	.0002	.0001	.0003	-.60
N	2,377	1,703	5,058	27,879	21,219	62,703	

All values are weighted by the inverse probability a claim has missing return to work information.
† Indicates mean statistically significantly different than corresponding mean in previous period (at the ten percent level).

Table 3-4: Financial Impact of Certain Percentiles in the Distribution of Claim Duration, Full Sample, PRE Period

Percentile	Non-Incentivized Injury, Days Away from Work	Share of Cash Benefits Accrued by Injured Workers at or Above Percentile	Incentivized Injury, Days Away from Work	Share of Cash Benefits Accrued by Injured Workers at or Above Percentile
	(1)	(2)	(3)	(4)
80	4	.99	7	.96
81	4	.99	7	.96
82	5	.98	7	.96
83	5	.98	8	.95
84	5	.98	8	.95
85	5	.98	9	.95
86	5	.98	10	.94
87	6	.97	13	.93
88	6	.97	14	.93
89	6	.97	18	.90
90	6	.97	20	.88
91	7	.96	24	.85
92	7	.96	28	.83
93	8	.96	34	.80
94	8	.96	42	.77
95	9	.96	52	.73
96	12	.95	66	.68
97	17	.89	86	.62
98	24	.72	126	.55
99	42	.56	255	.42

All values are weighted by the inverse probability a claim has missing return to work information.

Table 3-5: Share of Claims with Most Common Injuries Over Time (5-digit ICD-9 code in parentheses)

Non-Incentivized Injuries				Incentivized Injuries			
	PRE	POST1	POST2		PRE	POST1	POST2
Open wound, elbow/ forearm	.126	.120	.124	Open wound of finger	.185	.182	.180
Sprain back, thoracic	.121	.134†	.142†	Sprain back, lumbar	.079	.085†	.084
Contusion, chest wall	.074	.069	.069	Open wound of hand	.049	.051†	.049†
Open wound of scalp	.072	.059†	.069†	Sprain and strain of lower back	.049	.046	.046†
Open wound of forehead	.060	.050†	.054	Superficial injury of cornea	.036	.027†	.033†
Toxic effect of venom	.058	.044†	.047	Sprain and strain of ankle	.035	.036	.041†
Contusion, knee/lower leg	.052	.052	.055	Sprain and strain of neck	.032	.029†	.032†
Sprain and strain, other	.038	.044†	.045	Foreign body in eye, cornea	.031	.029†	.023†
Toxic effect of gas/vapor	.032	.034	.024†	Contusion, finger	.027	.029†	.026†
Open wound of hip/thigh	.034	.027†	.028	Sprain, shoulder/upper arm	.026	.030†	.030
Sprain and strain, pelvis	.030	.036†	.032†	Sprain and strain of wrist	.025	.027†	.029†
Conjunctivitis	.024	.019†	.020	Contusion, wrist and hand	.025	.027†	.026
Broken tooth	.023	.024	.016†	Contusion, face, scalp, neck	.025	.025	.027†
Dermatitis	.023	.027†	.028	Sprain and strain, knee/leg	.023	.025†	.029†
Superficial keratitis	.020	.024†	.024	Contusion, knee	.023	.024	.025†
Open wound of face	.019	.017	.015	Contusion, foot	.020	.020	.019†
Contusion, hip and thigh	.019	.017	.017	Foreign body in eye, other	.019	.025†	.018†
Burn, eye	.018	.020	.014†	Open wound: knee, leg, thigh	.015	.015	.015
Sprain and strain, ribs	.016	.016	.014	Sprain and strain, hand	.013	.014†	.013†
Electrocution	.016	.013†	.016†	Contusion, elbow	.011	.011	.011
Other	.130	.154	.145	Other	.253	.242	.244

All means are weighted by the inverse probability a claim has missing return to work information.
† Indicates mean statistically significantly different than corresponding mean in previous period (at the ten percent level).

Table 3-6: Demographic and Job Characteristics

	Non-Incentivized Injuries			Incentivized Injuries			
	PRE	POST1	POST2	PRE	POST1	POST2	t statistic $PRE_{non\text{-}inc}$ $=PRE_{inc}$
Demographic characteristics							
Male	.762	.758	.747†	.703	.688†	.671†	14.96
Married	.496	.440†	.425†	.500	.448†	.430†	-.90
Age	33.178	33.247	33.504†	33.477	33.360	33.855†	-3.17
	(10.755)	(10.928)	(11.122)	(10.817)	(10.868)	(11.218)	
Ages 18-29	.438	.443	.437	.425	.434†	.421†	3.01
Ages 30-39	.302	.285†	.269†	.300	.285†	.272†	.28
Ages 40-49	.168	.176†	.189†	.179	.186†	.199†	-3.36
Ages 50-59	.075	.076	.087†	.079	.078	.090†	-1.50
Ages 60-64	.018	.020	.017†	.017	.016†	.018†	.58
Occupation							
Manager	.041	.050	.039†	.039	.051†	.039†	1.35
Service worker	.258	.238†	.259†	.298	.284†	.314†	-10.07
Support	.057	.064†	.066	.060	.070†	.070	-1.46
Production	.405	.396	.363†	.392	.373†	.342†	3.09
Laborer	.217	.220	.238†	.198	.201	.214†	5.47
N	14,906	11,550	32,800	109,187	85,978	237,112	

All means are weighted by the inverse of the predicted probability a claim has valid return to work information.
† Indicates mean statistically significantly different than corresponding mean in previous period (at the ten percent level).

Table 3-7: Characterizing Claim Duration, Results from Ordinary Least Squares

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
POST1	-.176	-1.750	-2.647	-.359	.321
	(.892)	(1.306)	(3.007)	(.880)	(.266)
POST1*INCENT	-.601	-1.966	-2.947**	.110	-.166
	(.700)	(1.724)	(1.342)	(.416)	(.183)
POST2	-.934	-.996	-2.313	-.865	-.036
	(.834)	(1.554)	(2.879)	(.965)	(.346)
POST2*INCENT	1.247	.638	1.865*	.687**	.034
	(.796)	(.816)	(1.100)	(.181)	(.196)
Male	-1.038**	-.621	-2.990**	.293*	.088*
	(.464)	(.630)	(.666)	(.174)	(.051)
Age	.212**	.267**	.596**	.068**	.017
	(.056)	(.121)	(.065)	(.012)	(.010)
Married	-.1.972**	-1.237*	-2.513**	-.578**	-.255**
	(.472)	(.718)	(.962)	(.196)	(.061)
Manager	-3.390**	-1.991	-4.982**	.025	-.285**
	(.934)	(1.973)	(2.356)	(.747)	(.132)
Service Worker	-1.460**	-1.025	-1.853	-.700**	.091
	(.497)	(.791)	(1.367)	(.272)	(.101)
Support Worker	-1.218**	-.705	-1.079	-1.218**	-.326**
	(.598)	(1.019)	(1.528)	(.433)	(.102)
Production Worker	1.481**	2.031**	4.239**	.402	.198**
	(.496)	(.796)	(1.344)	(.367)	(.049)
N	491,533	130,291	78,701	87,638	120,939
R^2	.212	.032	.017	.009	.006
Mean of Dependent Variable	13.012 (66.038)	11.378 (55.513)	21.870 (83.423)	4.822 (23.494)	2.680 (8.513)
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.014	.030	.0001	.149	.018

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. The left out occupation is Laborer. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Regressions are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Table 3-8: Characterizing Claim Duration, Results from Ordinary Least Squares on the Sample of Medical Only Claims

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
POST1	-.325**	-.281**	-.464**	-.294**	-.229**
	(.036)	(.077)	(.038)	(.107)	(.029)
POST1*INCENT	-.033	-.131	-.016	-.133	-.040**
	(.042)	(.087)	(.068)	(.081)	(.016)
POST2	-.285**	-.255**	-.284**	-.368**	-.235**
	(.036)	(.076)	(.028)	(.071)	(.043)
POST2*INCENT	-.009	-.069	-.010	-.010	-.019**
	(.037)	(.065)	(.031)	(.049)	(.004)
Male	.017	.046**	.045*	.024	-.010
	(.012)	(.016)	(.025)	(.020)	(.010)
Age	-.003**	-.003**	-.004**	-.002**	-.003**
	(.0004)	(.001)	(.001)	(.001)	(.0004)
Married	-.078**	-.033	-.029	-.076**	-.086**
	(.009)	(.020)	(.039)	(.016)	(.006)
Manager	-.163**	-.169**	-.282**	-.139**	-.047
	(.037)	(.050)	(.029)	(.045)	(.042)
Service Worker	-.022	-.021	-.120**	-.0004	-.004
	(.015)	(.045)	(.049)	(.0358)	(.017)
Support Worker	-.005	-.001	-.093**	-.003	-.040**
	(.018)	(.040)	(.035)	(.048)	(.013)
Production Worker	.068**	.047**	.009	.095**	.027**
	(.014)	(.023)	(.046)	(.021)	(.010)
N	437,814	116,142	61,918	83,586	118,239
R^2	.090	.075	.022	.037	.019
Mean of Dependent Variable	2.521 (1.859)	2.815 (1.994)	3.353 (2.239)	2.542 (1.805)	1.953 (1.412)
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.199	.093	.896	.083	.290

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. The left out occupation is Laborer. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Regressions are weighted by the inverse of the probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Table 3-9: Characterizing Claim Duration, Results from Ordinary Least Squares on the Sample of Cash Benefit Claims

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
POST1	-1.602	-6.551	-8.692	4.818	6.369
	(6.914)	(8.462)	(8.689)	(12.548)	(6.309)
POST1*INCENT	7.153*	.725	3.887	2.777	6.775
	(4.084)	(4.227)	(2.984)	(6.687)	(4.475)
POST2	-4.121	3.699	2.573	-2.823	-5.146
	(7.595)	(12.337)	(11.850)	(15.309)	(7.684)
POST2*INCENT	19.902**	19.216**	21.701**	15.172**	7.802
	(5.208)	(4.188)	(4.742)	(4.540)	(4.786)
Male	-7.073**	-1.932	-6.005**	-.053	1.142
	(2.638)	(2.695)	(2.625)	(2.028)	(1.142)
Age	1.104**	1.274**	1.517**	.417**	.225
	(.122)	(.227)	(.090)	(.154)	(.138)
Married	-6.658**	-3.325	-3.604	-5.456*	-2.923
	(1.835)	(2.831)	(2.694)	(2.912)	(1.986)
Manager	-1.160	9.511	5.281	23.671*	-2.675**
	(4.976)	(16.994)	(14.055)	(13.067)	(.725)
Service Worker	-7.308**	-5.071	-4.183	-4.553	6.602**
	(2.902)	(5.834)	(5.587)	(7.085)	(2.507)
Support Worker	-6.308	-5.821	-4.614	-13.049*	-3.230**
	(4.023)	(6.079)	(5.899)	(6.608)	(1.602)
Production Worker	-.083	-.087	1.429	-3.571	1.217
	(2.167)	(4.618)	(4.201)	(6.116)	(1.111)
N	53,719	14,149	16,783	4,052	2,700
R^2	.173	.045	.031	.050	.053
Mean of Dependent Variable	88.020 (170.603)	72.259 (144.004)	81.025 (156.784)	45.538 (92.744)	30.771 (44.576)
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.003	.000	.001	.036	.643

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. The left out occupation is Laborer. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Regressions are weighted by the inverse of the probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Table 3-10: Probability claim spans more than 15 months, Linear Probability Model

	(1)	(2)	(3)
Sample:	All Injuries	Common Injury Sample	Back Sprains
POST1	-.001 (.001)	-.002 (.002)	-.0035 (.0037)
POST1*INCENT	.00004 (.00049)	-.001 (.001)	-.0011** (.0003)
POST2	-.0016 (.0012)	-.001 (.002)	-.0020 (.0039)
POST2*INCENT	.002** (.001)	.002** (.001)	.0039** (.0011)
Male	-.001** (.0005)	-.0006 (.0005)	-.003** (.001)
Age	.0002** (.00005)	.0002** (.0001)	.0005** (.0001)
Married	-.001** (.0005)	-.001* (.0003)	-.002* (.001)
Manager	-.002** (.001)	-.001 (.002)	-.003 (.003)
Service Worker	-.001** (.0005)	-.001 (.001)	-.001 (.001)
Support Worker	-.0006 (.001)	-.001 (.001)	-.001 (.001)
Production Worker	.0005 (.0004)	.001* (.001)	.002** (.001)
N	491,533	130,291	78,701
R^2	.111	.009	.007
Mean of Dependent Variable	.006	.005	.011
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.011	.028	.005

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. The left out occupation is Laborer. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Linear probability models are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Table 3-11: Probability a Claimant Receives Vocational Rehabilitation Benefits, Linear Probability Model Results

	(1)	(2)	(3)
Sample:	All Injuries	Common Injury Sample	Back Sprains
Panel A: Prob. Cash Ben. Recip. Receives Voc. Rehab. Within 15 Months of Injury			
POST1*INCENT	.002**	.001	.002
	(.001)	(.001)	(.002)
POST2*INCENT	.006**	.004**	.008**
	(.002)	(.002)	(.001)
N	491,533	130,291	78,701
R^2	.071	.012	.008
Mean of Dep. Var.	.007	.007	.016
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.003	.034	.006
Panel B: Prob. Cash Ben.Recip. Receives Voc. Rehab. After 15 Months Since Injury			
POST1*INCENT	.0004	-.0007	-.0035**
	(.0006)	(.0007)	(.0008)
POST2*INCENT	.0007*	.0003	-.0006
	(.0003)	(.0005)	(.0005)
N	491,533	130,291	78,701
R^2	.088	.006	.004
Mean of Dep. Var.	.004	.003	.006
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.599	.045	.007

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Linear probability models are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Table 3-12: Probability a Claim Spans More than 15 Months if Claimant Does Not Receive Vocational Rehabilitation Benefits, Linear Probability Model Results

Sample:	(1) All Injuries	(2) Common Injury Sample	(3) Back Sprains
POST1*INCENT	-.0006	-.0008	-.0014**
	(.0004)	(.0008)	(.0003)
POST2*INCENT	.0003	-.0004	-.0006
	(.0005)	(.0007)	(.0006)
N	486,755	129,251	77,186
R^2	.067	.005	.004
Mean of Dep. Var.	.003	.002	.005
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.063	.236	.061

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Linear probability models are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Figures for Chapter 3

Figure 3-1: Timeline of Policy Changes: Introduction of Ohio Third-Party Case Managers (TCMs) and Implementation of the Return-to-Work Bonus Payment

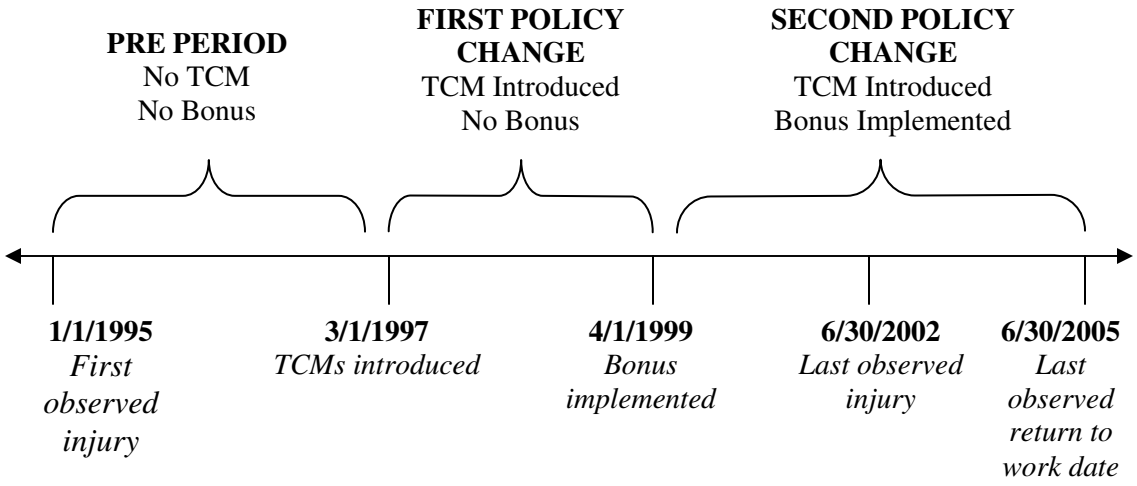


Figure 3-2: Share of Third-Party Case Managers (TCMs) Awarded Bonus Payment, by Quarter

Figure 3-3a: Marginal Costs and Benefits to Third-Party Case Managers (TCMs) of Reducing Claim Duration in Absence of Bonus Payment

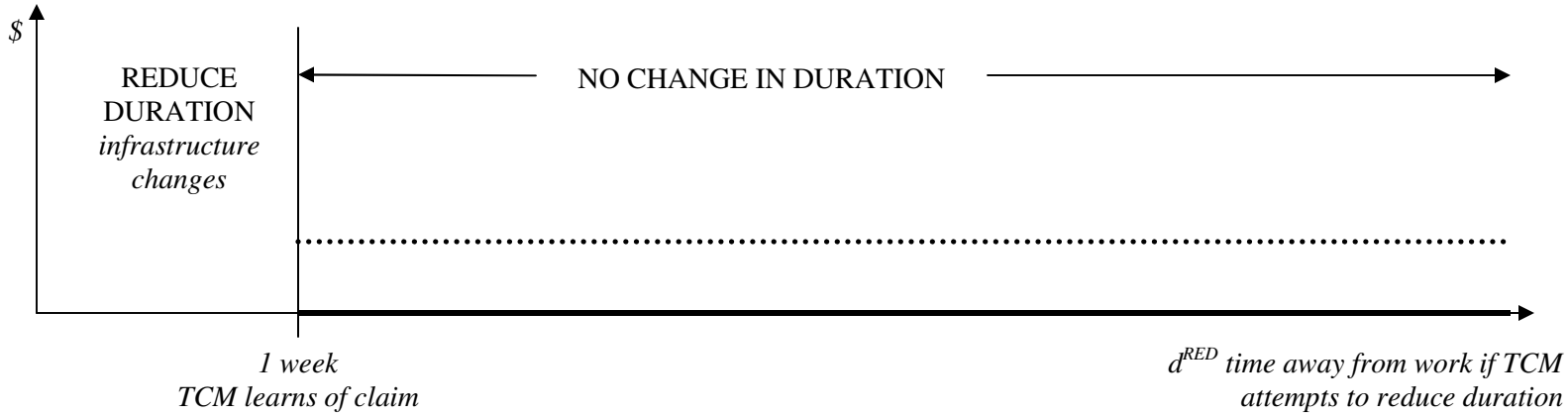
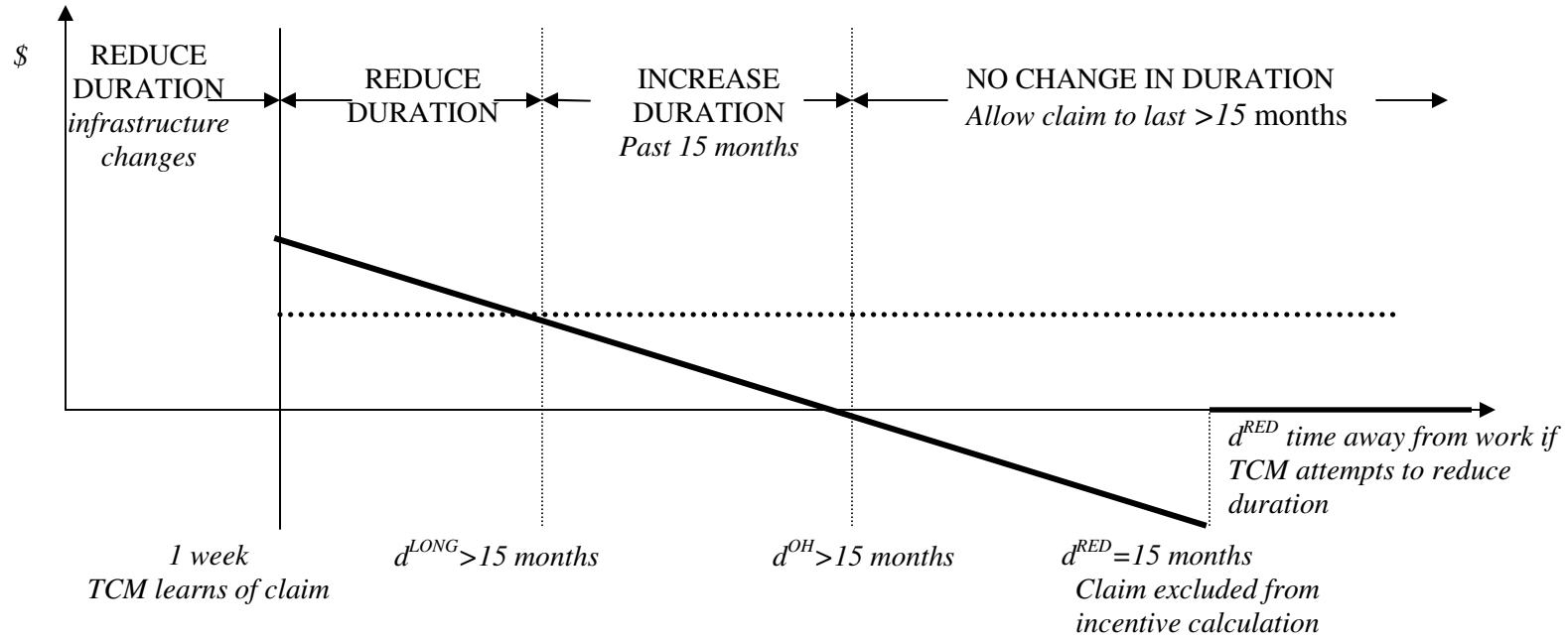


Figure 3-3b: Marginal Costs and Benefits to Third-Party Case Managers (TCMs) of Reducing Claim Duration for Incentivized Injuries After Bonus Payment



Figures 3-4a-3-4b: Quantiles in the Distribution of Claim Duration Over Time for the Sample of all Claims (Medical Only and Cash Benefit)

Figure 3-4a: 85th Percentile

Figure 3-4b: 90th Percentile

The first vertical line corresponds to the implementation of the Third Party Case Managers (TCMs) (POST1) and the second vertical line corresponds to the introduction of the bonus payment (POST2). The distributions are weighted by the inverse of the probability a claim has valid return to work information.

Figures 3-4c-3-4d: Quantiles in the Distribution of Claim Duration Over Time for the Sample of all Claims (Medical Only and Cash Benefit)

Figure 3-4c: 95th Percentile

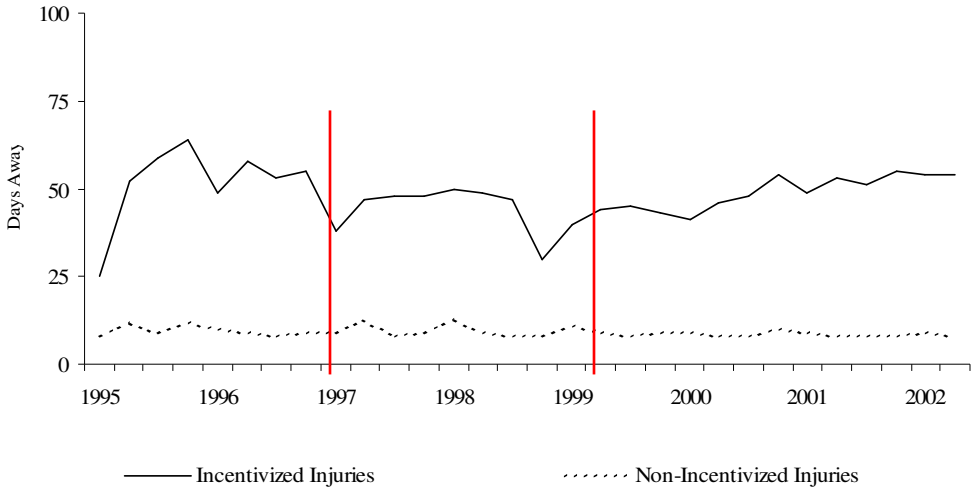
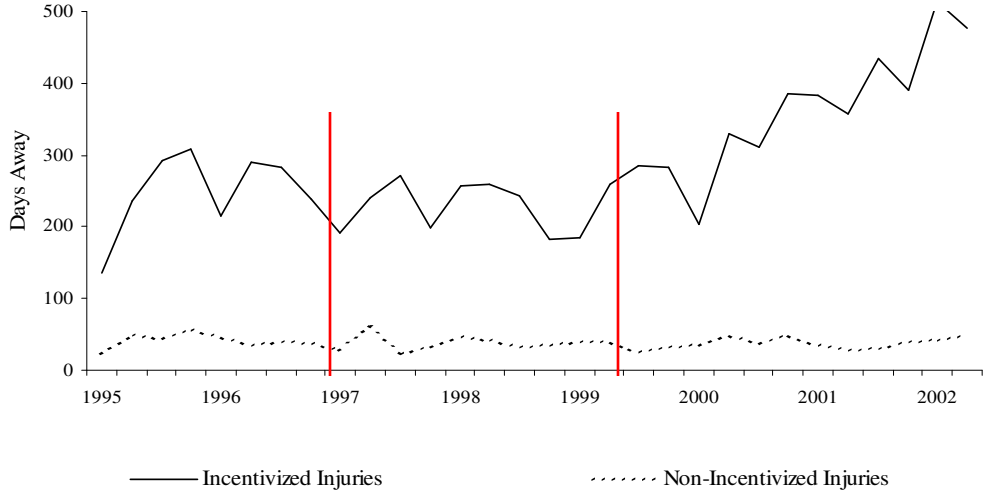
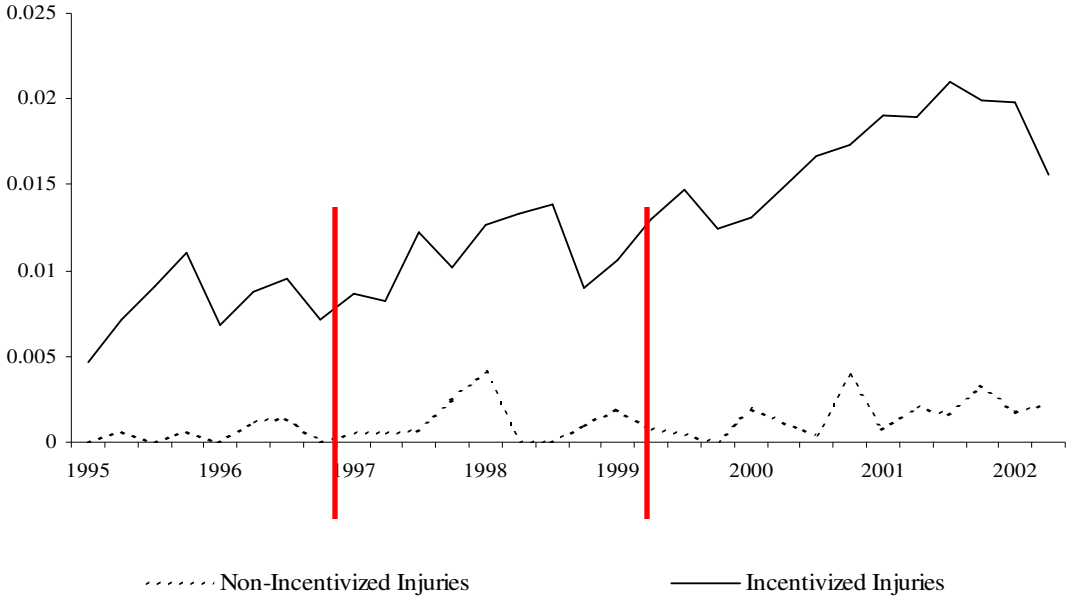


Figure 3-4d: 99th Percentile



The first vertical line corresponds to the implementation of the Third Party Case Managers (TCMs) (POST1) and the second vertical line corresponds to the introduction of the bonus payment (POST2). The distributions are weighted by the inverse of the probability a claim has valid return to work information.

Figure 3-5: Share of Claimants Receiving Vocational Rehabilitation Benefits Over Time



The first vertical line corresponds to the implementation of the Third-Party Case Managers (POST1) and the second vertical line marks the introduction of the bonus payment (POST2).

Figure 3-6a: Coefficient Estimates and 90-Percent Confidence Intervals for *POST1*INCENT* from Quantile Regressions on Days Away from Work

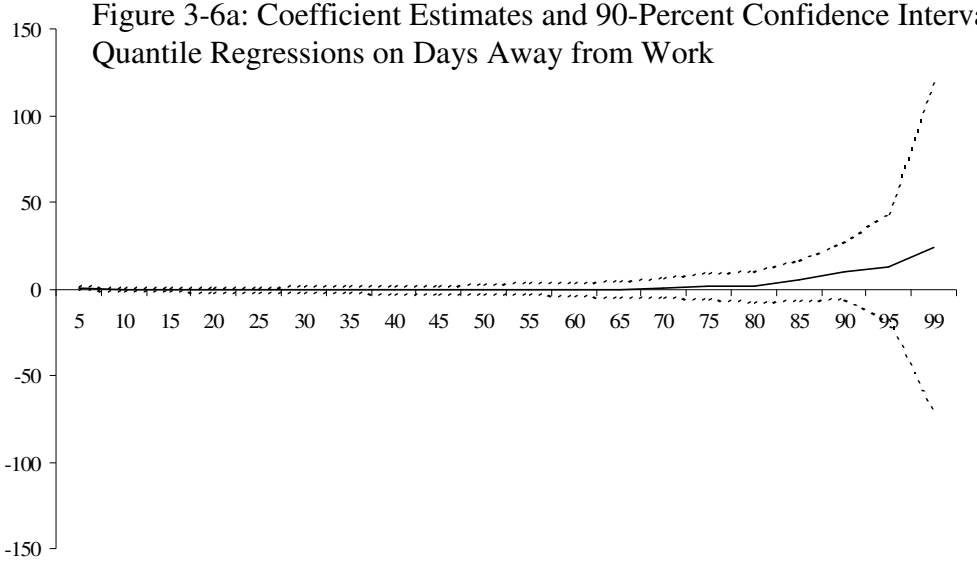
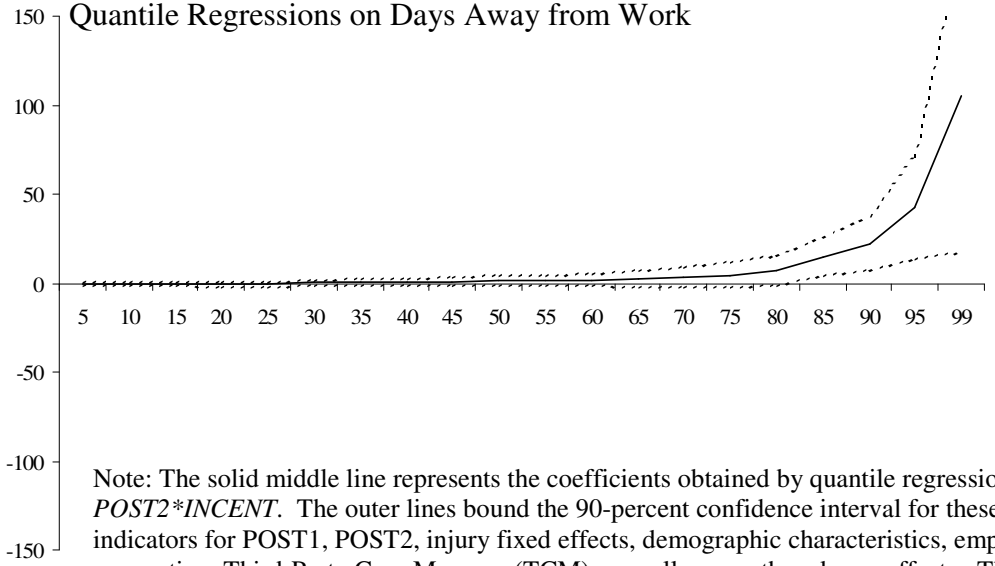


Figure 3-6b: Coefficient Estimates and 90-Percent Confidence Intervals for *POST2*INCENT* from Quantile Regressions on Days Away from Work



Note: The solid middle line represents the coefficients obtained by quantile regression for the variables *POST1*INCENT* and *POST2*INCENT*. The outer lines bound the 90-percent confidence interval for these coefficients. Each regression also includes indicators for POST1, POST2, injury fixed effects, demographic characteristics, employer characteristics, 1-digit industry, 1-digit occupation, Third-Party Case Manager (TCM), as well as month and year effects. These results are for the sample of cash benefit claims.

Appendices

Appendix A: Investigating Strategic Re-Labeling

A TCM might maximize the bonus payment by strategically assigning claims as incentivized or non-incentivized. In essence, the TCM may not impact duration but influence how claims are coded to maximize the bonus payment. Such re-labeling responses are fairly widespread in response to other government programs. There is an established literature finding such behavior to evade taxes (e.g., Fisman and Wei, 2004) and to increase hospital reimbursement after a Medicare rate reduction (e.g., Dafny, 2005; Silverman and Skinner, 2004). For a TCM to maximize the bonus payment by strategic re-labeling, the doctor would code severe injuries as non-incentivized, and TCMs ignore these injuries—no increase or decrease in duration. Results presented in Tables 3-9 through 3-12 quantify an increase in days away from work for claims having incentivized injuries. However, if doctors are re-labeling some severe injuries as non-incentivized, then these estimated increases in duration are upper bounds of the policy's impact. These estimates exclude severe claimants re-labeled as non-incentivized, and duration for these injuries does not change as a result of the bonus payment.

However, I do not anticipate finding such a re-labeling effect in this case. The presence of strategic re-labeling would be more plausible if the bonus payment induces a reduction in claim duration, and for strategic re-labeling to be successful, TCMs must convince doctors to comply because the doctor diagnoses patients before the TCM learns

of the claim. This may be difficult for TCMs to do because the agent who would have to do the re-coding, the physician, does not directly benefit from a higher bonus.[90]

The doctor makes the diagnosis at the first visit, before it is known whether a particular claim will be longer or shorter than average. At this appointment, the doctor acquires information about the expected length of a particular claim, as well as information needed to file the claim that is available in the administrative data: the injured worker's age, gender, marital status, and occupation.[91] As shown in Tables 3-7 through 3-10, these attributes are predictors of claim duration. For example, older, female claimants have above average duration. Since the state benchmarks do not depend on these characteristics, one way for case managers to reduce average duration would be to diagnose all older, female claimants with non-incentivized injuries and vice versa.

To test if this observable information has an impact on the diagnosis made by the doctor, I regress whether or not the claim has an incentivized diagnosis on the doctor-observed demographic characteristics. I allow these characteristics to vary based on the time period when the claim was filed, as shown in the equation below

$$(3) \quad INCENT_{i,j,t}=\alpha_0+ \alpha_1 POST1_t+ \alpha_2 POST2_t+\alpha_3 PRE_t * X_i+ \alpha_4 POST1_t * X_i + \alpha_5 POST2_t * X_i + \kappa_j +\eta_t+ \mu_{i,j,t}$$

where *PRE*X* is a vector of demographic characteristics interacted with a dummy variable for the *PRE* period and κ captures general descriptors of the injury, not the five-

[90] In the previous re-labeling literature, the agents doing the re-labeling benefit from the strategic behavior (e.g., the hospital employees who map a physician's diagnosis to a Medicare Diagnosis Related Group (DRG), as is the case in Dafny (2005), or an exporter labeling a product to evade taxes, as in Fisman and Wei (2004)).

[91] Form BWC-1101 (Rev. 8/2004) FROI-1 "First Report of an injury, occupational disease or death" ohiobwc.com.

digit ICD-9 codes. Thus, if doctors are shifting diagnoses to manipulate the bonus payment, the coefficient on *POST2*AGE* is expected to be negative and statistically significantly different than the coefficients on *PRE*AGE* and *POST1*AGE* because before the bonus is implemented, there is no reason for doctors to strategically diagnose injuries.

The results from this analysis are shown in Appendix Table A. The results in Panel A quantify any differences in the probability claims are assigned incentivized injuries between periods. In column (1), before the sample composition is restricted, it appears claims are less likely to have incentivized injuries over time. However, once the sample is restricted to common injuries, there is no clear trend in the probability of being diagnosed with an incentivized injury. In Panel B, I present results from equation (3). Only the results from the demographic characteristics interacted with *POST2* are shown, but the results from the other two periods are quite similar. Panel B, column (1) contains results from the full sample of claims. Few coefficients are statistically significantly different than zero and all are small in magnitude. The coefficient on *POST2*MALE* is -.012. In *POST2*, males are 1.2 percentage points, or 1.4 percent, less likely to be diagnosed with an incentivized injury than female workers.[92] The coefficient on *POST2*AGE* is .0008. This suggests that an individual ten years older than an otherwise observably similar claimant is .0008 percentage points, or about one-tenth of one percent, more likely to be diagnosed with an incentivized injury once the bonus is implemented. These are both small effects that are inconsistent with the re-labeling hypothesis. Since

[92] In fact, the only statistically significant difference in the interaction terms for a demographic characteristic over time is found for *MALE*PR*E and *MALE*POST2* in columns (1) and (2). However, not only are both coefficients close to zero, in *POST2*, males are *less* likely to be assigned an incentivized injury. This is inconsistent with the re-labeling hypothesis.

older workers return to work more slowly, a negative coefficient would be consistent with TCMs re-labeling to maximize the bonus payment. In total, the results show no evidence of strategic re-labeling in any sample; the coefficients are small, rarely statistically significant, and often the sign is inconsistent with the re-labeling hypothesis.

Appendix Table A: Probability a Claim is Assigned an Incentivized Diagnosis, Linear Probability Model

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
Panel A					
POST1	-.011**	-.001	.009	-.006	-.003
	(.003)	(.009)	(.009)	(.007)	(.003)
POST2	-.018**	-.014	.005	-.016*	.003
	(.004)	(.011)	(.011)	(.009)	(.004)
R^2	.39	.19	.01	.37	.82
Panel B					
POST2	-.006	.015	.037	.017	-.021**
	(.008)	(.024)	(.026)	(.019)	(.007)
POST2*Male	-.012**	-.028**	-.009**	-.028**	.004**
	(.001)	(.004)	(.004)	(.003)	(.001)
POST2*Age	.0008**	.0009**	.003**	-.001**	.0001**
	(.00005)	(.0002)	(.0002)	(.0001)	(.00006)
POST2*Married	.002*	.002	.0005	-.0003	-.002*
	(.001)	(.003)	(.003)	(.003)	(.001)
POST2*Manager	.011*	.032*	.039*	.004	.007
	(.006)	(.018)	(.020)	(.014)	(.006)
POST2*Service Worker	.004	.027	.029	.008	.002
	(.006)	(.017)	(.019)	(.013)	(.005)
POST2*Support Worker	-.002	.004	.016	.004	.0003
	(.006)	(.018)	(.019)	(.014)	(.0060)
POST2*Production Worker	.006	.013	.018	-.008	.002
	(.006)	(.017)	(.019)	(.013)	(.005)
POST2*Laborer	.010	.025	.024	-.005	-.001
	(.006)	(.017)	(.019)	(.013)	(.005)
R^2	.39	.19	.01	.37	.82
N	491,533	130,291	78,701	87,638	120,939
Mean of Dep. Variable	.88	.78	.90	.89	.92

Each regression includes indicators for POST1 and POST2, year and month dummy variables, broad injury categories (bruised head, cut head, bruised back, eye, sprained back, bruised arm, fractured arm, cut arm, sprained arm, cut hand, bruised leg, fractured leg, cut leg, sprained leg, and the left out category is other), employer characteristics, 1-digit industry, and TCM fixed effects. The regressions in Panel A also include demographic characteristics and 1-digit occupation. The regressions in Panel B also include a vector of demographic and occupation characteristics interacted with PRE and POST1. Linear probability models are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

Appendix B: Incidence of missing return to work information

	Full Sample	Medical Only	Cash Benefit
Panel A: Sample size before valid return-to-work information criteria imposed			
PRE	278,210	235,673	42,537
POST1	243,573	212,017	31,556
POST2	347,854	302,750	45,104
Incentivized Injuries			
PRE	231,613	193,866	37,747
POST1	204,320	176,130	28,190
POST2	293,205	252,507	40,698
Non-Incentivized Injuries			
PRE	46,597	41,807	4,790
POST1	39,253	35,887	3,366
POST2	54,649	50,243	4,406
Panel B: Sample size after valid return-to-work information criteria imposed			
PRE	140,085	116,203	23,882
POST1	108,853	91,086	17,767
POST2	298,158	273,236	24,922
Incentivized Injuries			
PRE	116,888	95,309	21,579
POST1	91,931	75,867	16,064
POST2	251,608	228,941	22,667
Non-Incentivized Injuries			
PRE	23,197	20,894	2,303
POST1	16,922	15,219	1,703
POST2	46,550	44,295	2,255
Panel C			
Share of Incentivized Injuries missing return-to-work information			
PRE	.495	.508	.428
POST1	.550	.569	.430
POST2	.142	.093	.443
Share of Non-Incentivized Injuries missing return-to-work information			
PRE	.502	.500	.519
POST1	.569	.576	.494
POST2	.148	.118	.488

PRE refers to the period before the Third-Party Case Managers (TCMs) or incentive payment are implemented (1/95-2/97); POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99); and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). There are 869,637 observations before the valid return-to-work information criteria is imposed, and 547,096 observations remain after it is imposed.

Appendix C: Probability claim spans more than 1 week, Linear Probability Model

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
POST1	-.005 (.005)	-.020** (.008)	-.027* (.014)	-.021** (.007)	.011* (.006)
POST1*INCENT	-.011* (.006)	-.017 (.014)	-.032** (.009)	.013** (.005)	-.009* (.005)
POST2	-.010 (.007)	-.032** (.009)	-.052** (.007)	-.017* (.009)	.009 (.007)
POST2*INCENT	-.015** (.007)	-.018 (.015)	-.033** (.005)	.007 (.005)	-.005 (.004)
Male	-.005* (.003)	-.007 (.006)	-.027** (.003)	.004* (.002)	.003* (.001)
Age	.001** (.0002)	.002** (.001)	.003** (.0004)	.001** (.0001)	.0004** (.0001)
Married	-.012** (.002)	-.008** (.003)	-.016** (.004)	-.004** (.001)	-.003** (.001)
N	491,533	130,291	78,701	87,638	120,939
R^2	.258	.099	.038	.023	.007
Mean of Dependent Variable	.123	.123	.238	.053	.025
p-value: Coefficients on POST1*INCENT, POST2*INCENT equal	.186	.924	.823	.099	.009

POST1 refers to the period when the TCMs are in place but the incentive is not (3/97-3/99) and POST2 refers to the period when the TCMs and incentive are in place (4/99-6/02). INCENT=1 if the claim has an incentivized injury. Each regression also includes year and month dummy variables and injury fixed effects (five-digit ICD-9 codes) as well as employer characteristics (experience rating and method of rating); 1-digit industry; and TCM fixed effects. Standard errors are clustered by injury (five-digit ICD-9 code). Test statistics are from Wald tests. Linear probability models are weighted by the inverse probability a claim has valid return-to-work information.

* Indicates significance at the ten percent level

** Indicates significance at the five percent level

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