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

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Abstract

Workers' Compensation (WC) is a large social insurance program that provides medical care and cash benefits to workers injured on the job. In response to rising employer costs, many states have passed policy reforms to reduce these costs. In this paper I examine one such reform enacted by 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 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. Although duration decreases by one third of a day for minor claims it increases by nearly three weeks for severe claims, resulting in an overall increase in days away from work. Participation in vocational rehabilitation programs is one mechanism contractors might use to increase claim duration, and I find the bonus induces an increase in enrollment. These conclusions suggest public entities should carefully anticipate potential strategic behavior when crafting the structure of performance-based incentives.

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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 largely attributed to the 44 percent increase in benefits paid during this same time period.[5] In response, many states passed policy reforms in an effort to reduce these employer costs. Several different types of policies were enacted, some of which addressed employer costs directly by deregulating premiums or expanding opportunities for employers to self-insure.[6] 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. 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.[7]

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[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.
[5] Sengupta et al., 2006.
[6] Barkume and Ruser, 2001; Sengupta et al., 2006.
[7] These papers examine reforms that differ from the intervention examined in this paper. Some states gave the privilege of selecting the treating doctor to employers and other states made it harder for workplace injuries to quality for WC if the injury is difficult to confirm with objective medical evidence (e.g., back sprains) or aggravates a pre-existing condition. The findings are mixed and suggest modest impacts.

In this paper 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.[8] 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.

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

[8] 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.

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 attempt 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 injuries 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 duration 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.[9] By enrolling injured workers in vocational 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.

[9] 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 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 by about one-third of a day 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 worker productivity, I estimate the bonus payment may cost the state between $26.4 and $39.4 million per year.

2. Workers' Compensation Insurance, Third-Party Case Managers, and the Bonus Payment

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.[10] Nationwide, approximately half of all benefits are paid by private insurers, with the other half

[10] Self-insured employers must provide the state-mandated level of benefits.

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.[11] If an employer purchases WC insurance from a private or public insurer, the premiums are an increasing function of how risky the employer's business is (base premium) and the employer's loss history (experience rate). For example, the base premium for coal miners is approximately ten times that of university professors.[12] 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. Therefore, the most productive efforts to reduce benefits paid will target particularly severe claims.

As illustrated in Appendix A, the beginning of a claim is rather straightforward; a worker is injured on the job, seeks medical care from a doctor, and the doctor 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

[11] The five states are Ohio, North Dakota, Washington, West Virginia, and Wyoming. In 2005, nearly 20 percent of the benefits paid on Ohio were paid by self-insured employers (Sengupta, et al., 2006).
[12] 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.

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. The state may attempt to expedite this process by implementing policies to reduce claim duration, such as mandating TCMs. During the 1990s, many states enacted WC policy reforms intended to reduce employer costs, and the introduction of TCMs in Ohio was the largest statewide effort to reduce claim duration.

2.2 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.[13] In Ohio, TCMs are currently managing every

[13] 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

claim insured by the state.[14] The TCMs were implemented in Ohio in two phases, as shown in Figure 1. In 1997, the state contracted out case management services to TCMs in hopes of curbing employer costs.[15] Case management involves medically managing claims and expediting return-to-work.[16] 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).[17] Employers continue to pay premiums to the state but select which TCM will manage their claims during open enrollment every two years.[18] 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.[19] Beginning in 1999, the state incorporated a bonus payment that was a decreasing function of average days away from work for some claims.[20]

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

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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.

[14] 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.

[15] The legislation was passed in 1993.

[16] 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.

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

[18] 2006 MCO Agreement. Acquired from a public records request. Chapter 1, page 43.

[19] Donchess, Joel, Ohio Bureau of Workers' Compensation, personal communication, April 24, 2007.

[20] 2006 MCO Agreement. Acquired from a public records request. Appendix E.

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).[21] 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.[22]

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.[23]

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.[24] 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.[25]

2.3 The Return-to-Work Bonus Payment

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[21] Case managers are often nurses.
[22] 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.
[23] Curry, D., GatesMcDonald, personal communication, August 11, 2006.
Kafiti, Anthony, 888-OHIOCOMP, personal communication, August 14, 2006.
[24] The worker may work fewer hours or be paid a lower wage if he or she cannot work at full capacity.
[25] 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.

Two years after the TCMs were implemented, the state restructured TCM compensation to incorporate a performance-based component, the bonus payment. The bonus was intended to reward TCMs for effectively reducing claim duration.[26] 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.). [27] Figure 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.[28] 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.[29] Therefore, to facilitate 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

[26] 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 bonus payment to give the TCMs a chance to adjust to the process of managing claims.
[27] 2006 MCO Agreement. Appendix E, page 13. Acquired from a public records request.
[28] The codes are so detailed that at least 22 codes describe pain in the back or neck.
[29] 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.

in the calculation of the bonus payment.[30] In Table 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.[31] 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.[32] Therefore, a TCM can lower mean days away from work (a) by 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. Expected TCM Responses and Impact on Days Away from Work

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

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

[31] In practice, the bonus 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 bonus 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 bonus 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.

[32] To be precise, the bonus=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 averages are computed for those claims that have one of the "incentivized conditions and began and ended within the past 15 months.

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*.[33] 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. 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 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 over time. To illustrate this, I make a few simplifying assumptions. First, I assume that every claimant 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

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

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 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.[34] 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.

3.2 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 B, I examine strategic re-labeling and confirm that doctors do not appear to be manipulating claims in this way. Therefore, I focus on the incentives to impact days away from work.

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

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 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 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 3a, there are no marginal costs or benefits before claims are filed in the first week after injury, and the marginal cost remains the same—the cost of a phone call. However, the marginal benefit differs 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 case managers whether a claim has an incentivized injury, the injury's goal days away from work, and the amount of time since the injury.[35]

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

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

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.[36] 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 claimant would miss d^{LONG} days of 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 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 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. Therefore, it is an empirical question whether the TCM actively works to increase duration for all claims that exceed the threshold beyond which TCMs benefit if the claimant remains out of work past 15 months or ignores those claims that will miss 15 months no matter what the TCM does. I explore this matter in the empirical section.

3.3 Literature

Although no previous study addresses this link between TCMs and claim duration, evidence from other work suggests that TCM efforts to impact claim duration will be effective. 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 employer efforts to provide modified work or light duty to a recovering

[36] 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.

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 the same 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 rehabilitation program needs to begin approximately one year after injury.

The case manager may simply ignore those claimants who 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. When benefits become more generous, injured workers are more likely to claim cash benefits (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.

4. Data and Econometric Approach

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.[37] The extent of these sample restrictions on the data is shown in the first six rows of Table 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

[37] By law, claimants awarded either permanent death or total disability benefits are excluded from the bonus payment 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.

claimants return to work when benefits cease.[38] 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 (see Appendix C). 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.[39]

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). 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 work in the empirical

[38] 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.
[39] 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.

results. Therefore, I weight all results by the inverse probability that a claim has valid return-to-work information.[40]

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.[41] I further restrict the sample to those injuries that have more than 100 claims.[42] The final baseline sample has 491,533 observations.

4.2 Descriptive Statistics

Table 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 shorter than average duration 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

[40] 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.

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

[42] 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.

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 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.[43] Similarly, mean days away from work declined among claims having incentivized injuries, from 14.1 to 12.5. Table 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 days in PRE to three days in POST1. Similarly, among incentivized injuries the 75th percentile dropped from five to four days. These decreases are consistent with infrastructure changes successfully reducing days away from work 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 shows only modest changes in days away from work among non-incentivized injuries. For example, mean duration changed from 3.8 to 4.0 days, yet this difference is not statistically significant and there were only modest changes across the entire distribution of days away from work.

[43] As expected, descriptive statistics for days away from work are sensitive to weighting.

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 further 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.[44]

To illustrate that these changes were timed with the bonus payment's implementation, Figures 4a-4d depict changes over time for selected quantiles of the weighted distribution of claim duration, separately for claims having incentivized and non-incentivized injuries.[45] 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

[44] 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.
[45] Results are weighted by the inverse of the predicted probability a claim has valid return-to-work information.

corresponding percentile for claims with non-incentivized injuries 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. Duration at the 90th percentile followed a similar trend, 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, 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 5, this increase in vocational rehabilitation was timed with the policy change.

The descriptive statistics suggest increases in duration were concentrated among the top one percent of claims. Although this is a small share of claims, these injuries comprise a substantial fraction of WC costs, as shown in Table 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).[46] 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

[46] 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.

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 fraction 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 5 and 6 I examine how the composition of injured workers changed over time. Table 5 lists the most common injuries by incentivized status.[47] 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.

In Table 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.[48] 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 will be particularly important to control for demographic characteristics to ensure that any observed increase in days away from work is not simply a

[47] The composition of injuries over time is sensitive to weighting.
[48] Descriptive statistics for demographic and job characteristics are not sensitive to weighting.

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 will also be important to control for the claimant's occupation. As shown in the bottom of Table 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.

4.3 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 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 received 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.[49] 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*.[50] Let *INCENT* identify those claims assigned one of the 266 incentivized codes.[51] 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.[52] 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 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).

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[49] The main qualitative results are confirmed using a Cox proportional hazard analysis. In future work, I will allow the hazard to vary over time to better capture the expected heterogeneous responses (e.g., Card et al,, 2007; Meyer, 1990). 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.
[50] In this case, the left out category is *PRE*, the period before the TCMs are in place (1/95-2/97).
[51] The variable *INCENT* is not included by itself because it is perfectly correlated with γ.
[52] 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.

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 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.[53] 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 duration is shorter for men and longer for older workers.[54] Managers, service workers, and support personnel return to work more quickly than laborers.[55]

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

[53] In Appendix D, 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.

[54] 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.

[55] Following Evans and Owens (2007), 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.

*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.

The key results from quantile regression are shown in Figures 6a and 6b. In Figure 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 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.[56]

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 infrastructure. In contrast, TCMs are predicted to respond to the bonus payment and impact

[56] 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. In a baseline quantile regression conditional only on these injury fixed effects, there are great disparities in the days away from work at the 99th percentile (e.g., the 99th percentile for a sprain or strain of the knee corresponds to 1,066 days, whereas the 99th percentile for a burn on the forearm corresponds to 73 days).

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 focuses on 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.

Medical Only 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 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. The coefficients on the interaction terms are statistically significant, but they are not economically meaningful. The coefficient estimates imply workers return to their jobs between .02 and .04 days sooner. Thus, the conclusion that TCMs treat all minor claims in the same way, regardless of incentivized status, is upheld.

Cash Benefit 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 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 statistically 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.[57]

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 that has found that claimants suffering "traumatic" injuries, such as cuts or

[57] 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 D, 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.

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

Strategic Behavior to Increase Duration

To investigate whether or not TCMs are strategically making claims 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 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.

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

5. Mechanisms TCMs Use to Ensure Duration Exceeds 15 Months

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.

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 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 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. [58] 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.

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 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

[58] 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.

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 not ignored those injured workers who receive vocational rehabilitation benefits. Therefore, I restrict the sample to those injured workers who do not participate in any rehabilitation program. As shown in Panel C of Table 11, 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 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.

6. Discussion

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 the TCMs reduced claim duration for minor claims by an average of one-third of a day of work (see Table 8) and had no impact on any other group of claims (see Tables 7 and 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.[59] Assuming that a worker's productivity equals his or her daily wage, the productivity gained for each additional day worked averaged $88 per day in 2002, generating approximately $1.8 million in productivity gains.[60] 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 9) and had no impact on any other group of claims (see Tables 7 and 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.[61] This corresponds to $13.0 million in additional costs for vocational rehabilitation.[62] Therefore, when I include the costs of vocational rehabilitation, I estimate the bonus payment may cost the state up to $39.4 million per year.

Conclusion

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[59] These are weighted totals, not the actual sample size.
[60] U.S. Chamber of Commerce, 2003.
[61] In 2002, the state paid $55.3 million to vocational rehabilitation providers, and 1,125 individuals received vocational rehabilitation.
[62] 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.

In this paper, 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 in ways that 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.

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

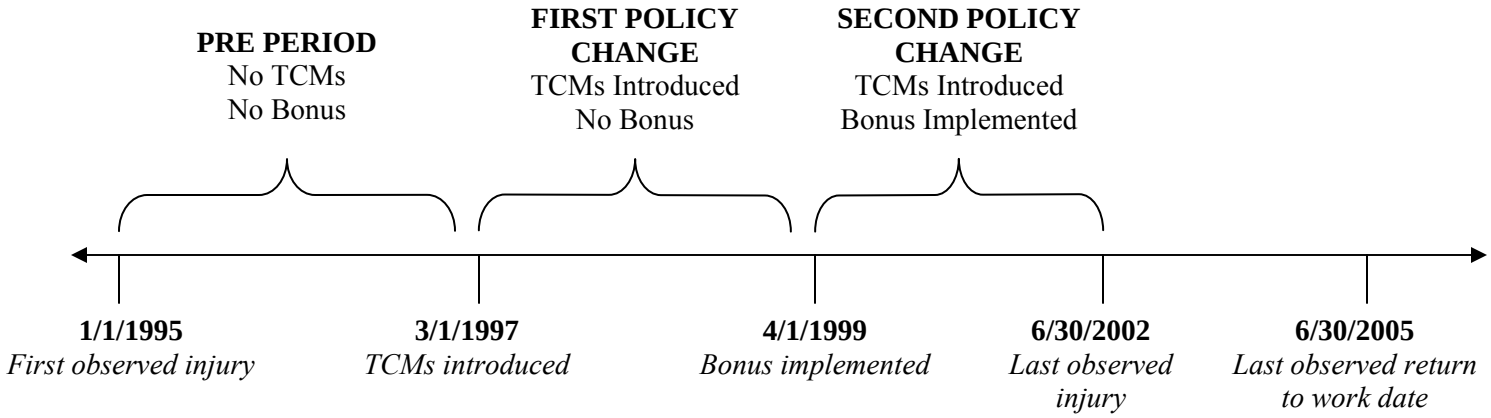
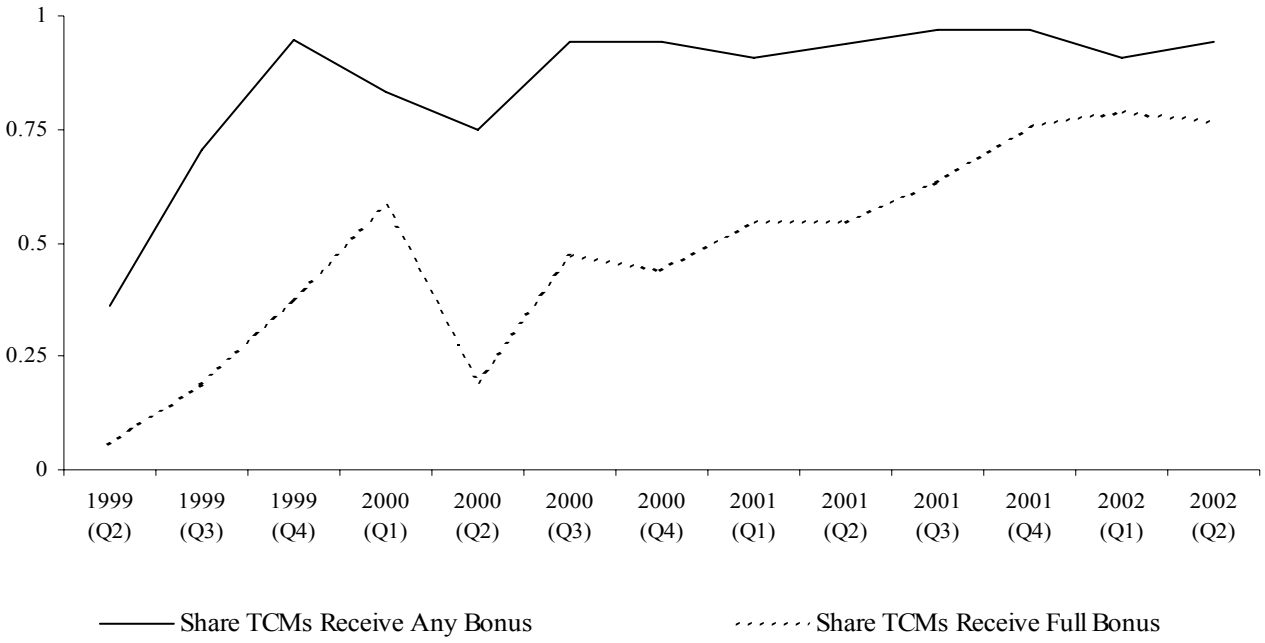


Figure 2: Share of Third Party Case Managers (TCMs) Awarded Bonus Payment, by Quarter



Source: Data acquired from public records request.

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

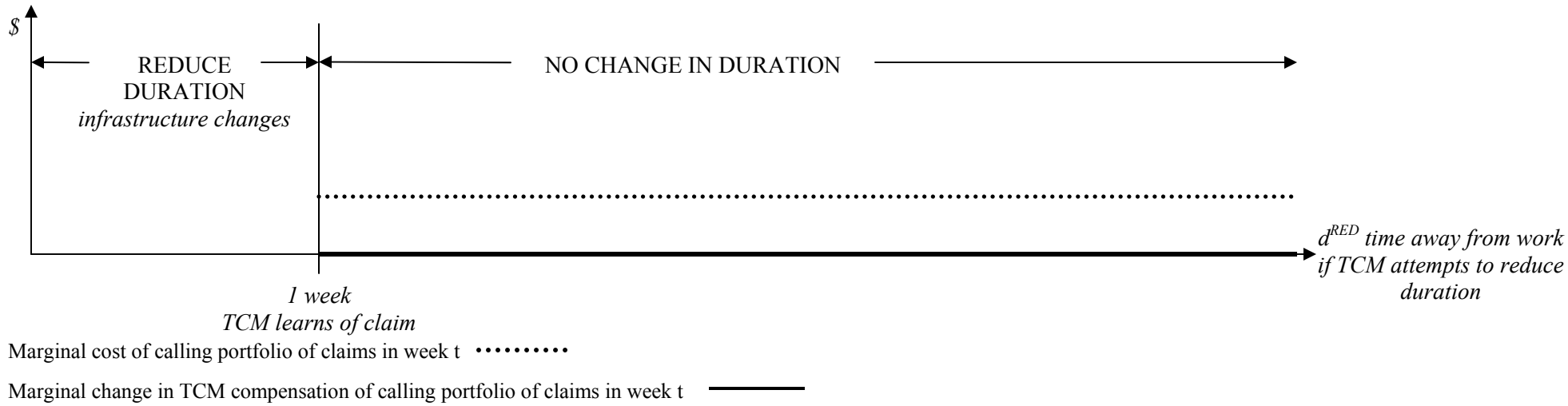
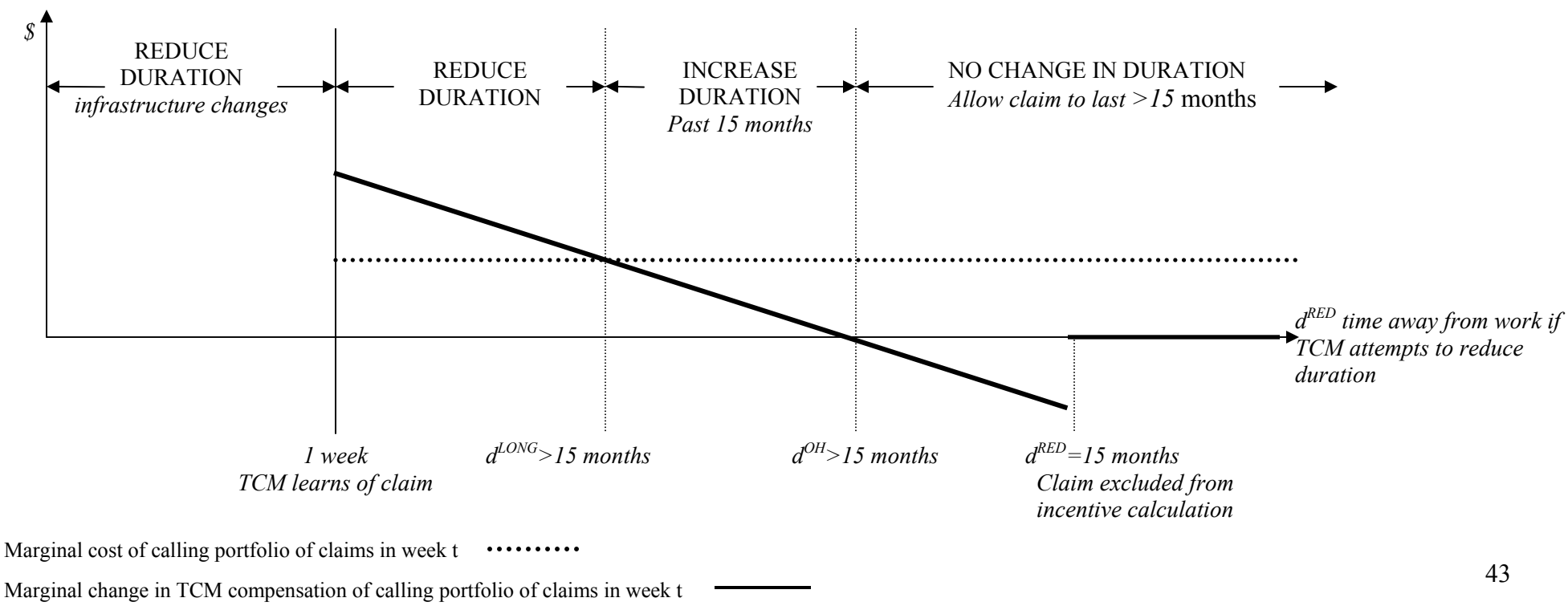
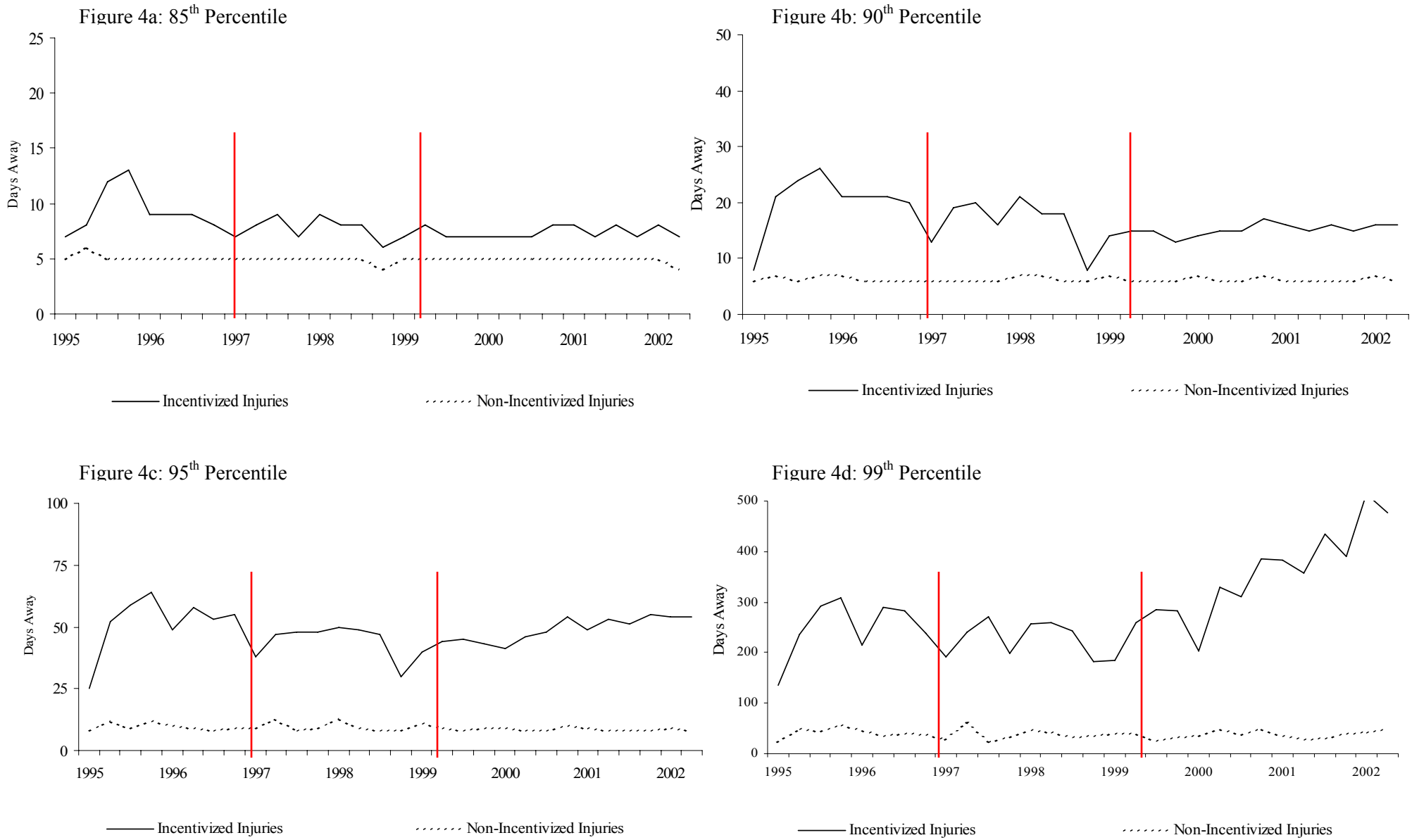


Figure 3b: Marginal Costs and Benefits to Third-Party Case Managers (TCMs) of Reducing Claim Duration for Incentivized Injuries After Bonus Payment

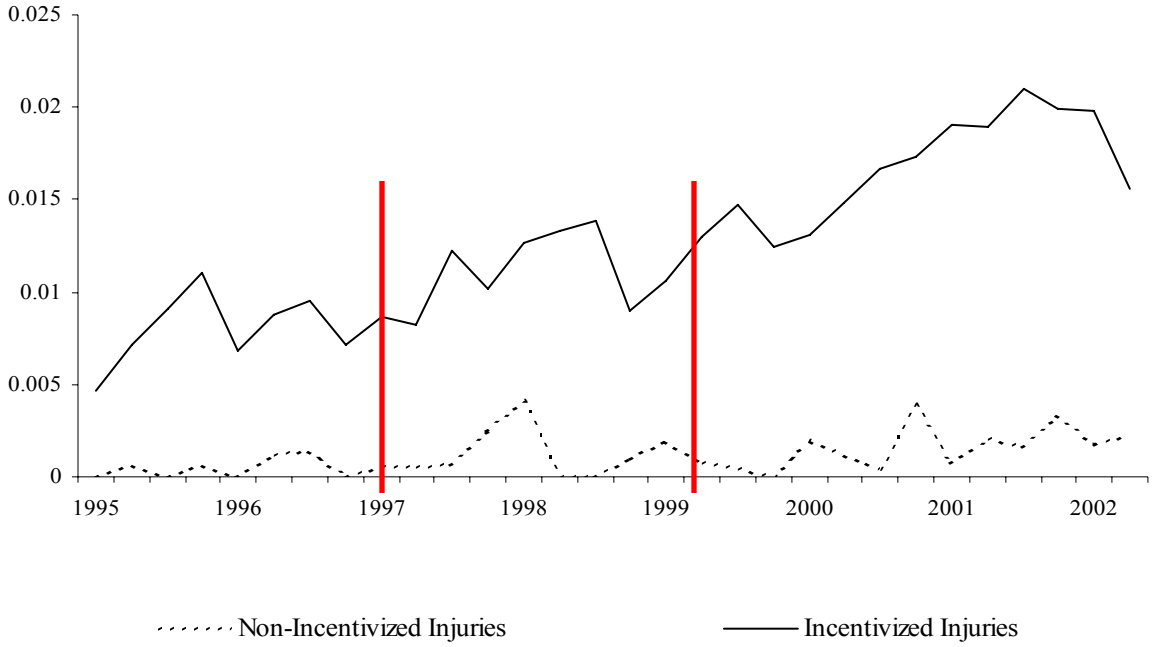


Figures 4a-4d: Selected Quantiles in the Distribution of Claim Duration Over Time, Sample of All Claims (Medical Only and Cash Benefit)



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 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). Observations are weighted by the inverse of the predicted probability the claim has valid return-to-work information.

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

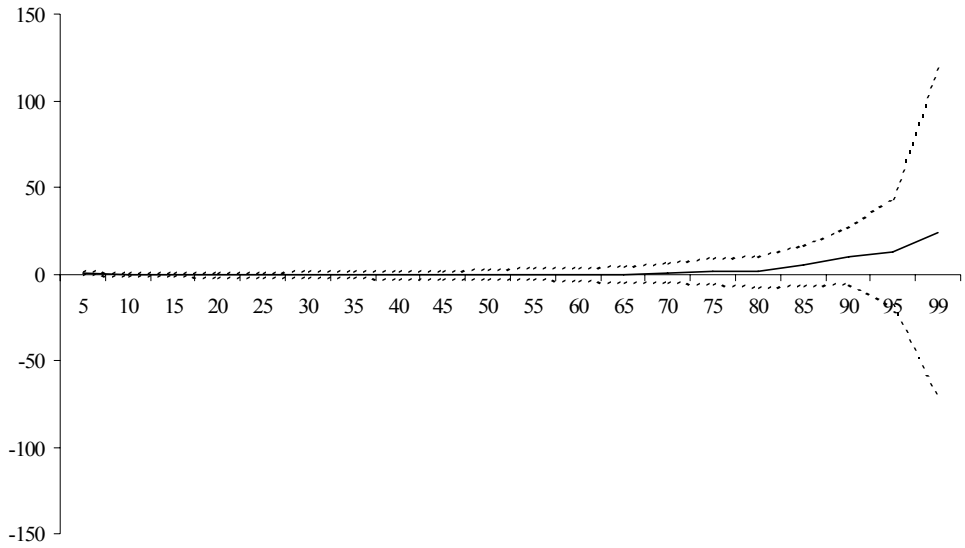
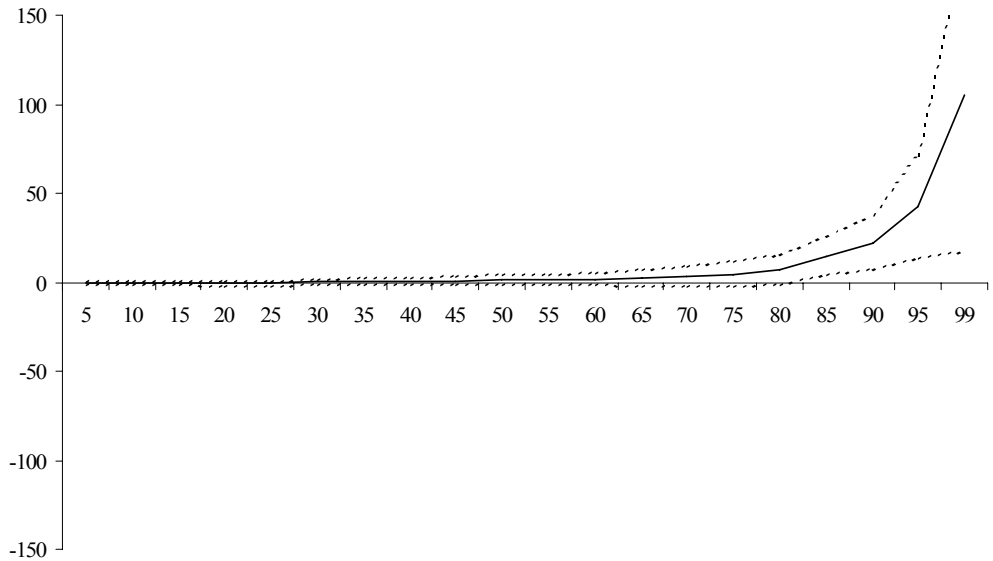


Figure 6b: Coefficient Estimates and 90-Percent Confidence Intervals for *POST2*INCENT* from Quantile Regressions on Days Away from Work



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 (five-digit ICD-9 code), 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.

Table 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 2: Sample Composition

	Full Sample	Medical Only	Cash Benefit
Number of claims	1,609,252	1,309,466	299,786
Preserve 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 each period[c]	530,316	465,844	64,472
Diagnosis has at least 100 claims	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]I identify workers in the data 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 criterion.

Table 3: Characterizing Claim Duration

	Non-Incentivized Injuries			Incentivized Injuries			
	PRE	POST1	POST2	PRE	POST1	POST2	$PRE_{non}=PRE_{inc}$ t-stat
Full Sample							
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	
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 4: Share of Benefits Accruing to Injured Workers at the Top of the Distribution of Claim Duration, Full Sample, PRE Period

	Non-Incentivized Injuries		Incentivized Injuries	
Percentile	Days Away from Work	Share of Cash Benefits Accruing to Injured Workers at or Above Percentile	Days Away from Work	Share of Cash Benefits Accruing to 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 5: Share of Claims with Most Common Injuries Over Time

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 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 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)
Occupation					
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)	(1.368)	(.272)	(.101)
Support	-1.218**	-.705	-1.079	-1.218**	-.326**
	(.598)	(1.019)	(1.528)	(.433)	(.102)
Production	1.481**	2.031**	4.239**	.402	.198**
	(.496)	(.796)	(1.344)	(.367)	(.049)
Laborer	--	--	--	--	--
N	491,533	130,291	78,701	87,638	120,939
R^2	.212	.032	.017	.009	.006
Mean of Dependent Variable	13.012	11.378	21.870	4.822	2.680
	(66.038)	(55.513)	(83.423)	(23.494)	(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. 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 8: Characterizing Claim Duration, Results from Ordinary Least Squares, 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)
Occupation					
Manager	-.163**	-.169**	-.282**	-.139**	-.047
	(.037)	(.050)	(.029)	(.045)	(.042)
Service Worker	-.022	-.021	-.120**	-.0004	-.004
	(.015)	(.045)	(.049)	(.0358)	(.017)
Support	-.005	-.001	-.093**	-.003	-.040**
	(.018)	(.040)	(.035)	(.048)	(.013)
Production	.068**	.047**	.009	.095**	.027**
	(.014)	(.023)	(.046)	(.021)	(.010)
Laborer	--	--	--	--	--
N	437,814	116,142	61,918	83,586	118,239
R^2	.090	.075	.022	.037	.019
Mean of Dependent Variable	2.521	2.815	3.353	2.542	1.953
	(1.859)	(1.994)	(2.239)	(1.805)	(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. 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 9: Characterizing Claim Duration, Results from Ordinary Least Squares, 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)
Occupation					
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	-6.308	-5.821	-4.614	-13.049*	-3.230**
	(4.023)	(6.079)	(5.899)	(6.608)	(1.602)
Production	-.083	-.087	1.429	-3.571	1.217
	(2.167)	(4.618)	(4.201)	(6.116)	(1.111)
Laborer	--	--	--	--	--
N	53,719	14,149	16,783	4,052	2,700
R^2	.173	.045	.031	.050	.053
Mean of Dependent Variable	88.020	72.259	81.025	45.538	30.771
	(170.603)	(144.004)	(156.784)	(92.744)	(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. 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 10: Probability Claim Spans More than 15 Months, Linear Probability Model

	(1)	(2)	(3)
Sample:	All Injuries	Common Injury Sample	Back Sprains
POST1	-.001	-.002	-.0035
	(.001)	(.002)	(.0037)
POST1*INCENT	.00004	-.001	-.0011**
	(.00049)	(.001)	(.0003)
POST2	-.0016	-.001	-.0020
	(.0012)	(.002)	(.0039)
POST2*INCENT	.002**	.002**	.0039**
	(.001)	(.001)	(.0011)
Male	-.001**	-.0006	-.003**
	(.0005)	(.0005)	(.001)
Age	.0002**	.0002**	.0005**
	(.00005)	(.0001)	(.0001)
Married	-.001**	-.001*	-.002*
	(.0005)	(.0003)	(.001)
Occupation			
Manager	-.002**	-.001	-.003
	(.001)	(.002)	(.003)
Service Worker	-.001**	-.001	-.001
	(.0005)	(.001)	(.001)
Support	-.0006	-.001	-.001
	(.001)	(.001)	(.001)
Production	.0005	.001*	.002**
	(.0004)	(.001)	(.001)
Laborer	--	--	--
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. 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 11: Probability a Claimant Receives Vocational Rehabilitation Benefits or a Spell Spans More than 15 Months, Linear Probability Model Results

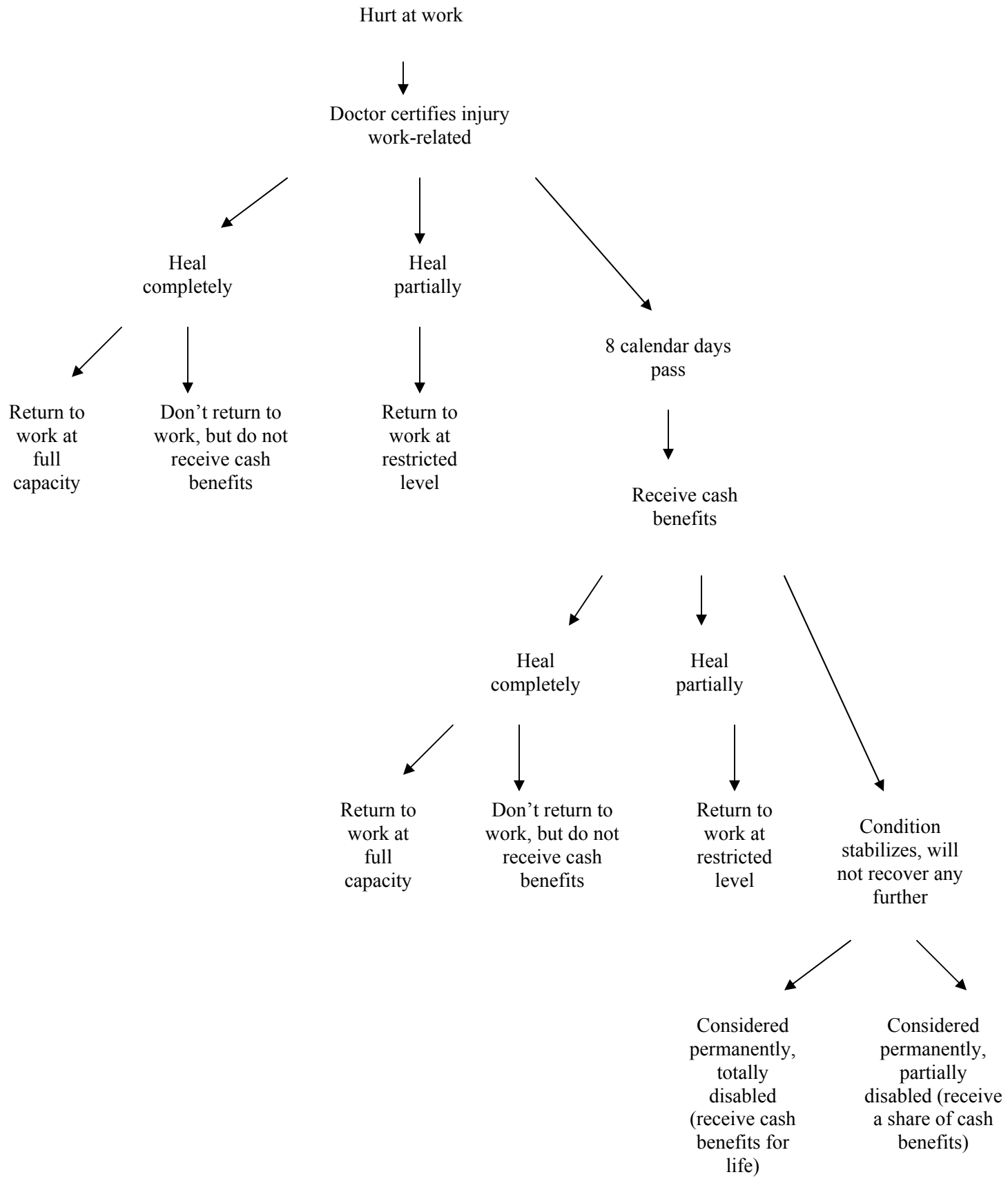
	(1)	(2)	(3)
Sample:	All Injuries	Common Injury Sample	Back Sprains
Panel A: Prob. Cash Ben. Recip. Receives Voc. Rehab. Within 15 Months of Injury			
POST1*INCENT	.002**	.001	.002
	(.001)	(.001)	(.002)
POST2*INCENT	.006**	.004**	.008**
	(.002)	(.002)	(.001)
N	491,533	130,291	78,701
R^2	.071	.012	.008
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. More than 15 Months After 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
Panel C: Prob. Spell Spans More than 15 Months if do not Receive Voc. Rehab.			
POST1*INCENT	-.0006	-.0008	-.0014**
	(.0004)	(.0008)	(.0003)
POST2*INCENT	.0003	-.0005	-.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 demographic characteristics (male, age, married); 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

Appendix A: A Workers' Compensation Claim



Appendix B: 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.

However, I do not anticipate finding such a re-labeling effect in this case.[63] The presence of strategic re-labeling would be more plausible if the bonus payment induced a reduction in claim duration. Furthermore, 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.[64]

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.[65] As shown in Tables 7 through 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

[63] In Tables 9 and 10, I estimate the bonus payment induced 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.
[64] 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)).
[65] Form BWC-1101 (Rev. 8/2004) FROI-1 "First Report of an injury, occupational disease or death" ohiobwc.com.

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

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-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 B. 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. [66] The coefficient on *POST2*AGE* is .0008. This suggests that an individual ten years older than an otherwise observably

[66] 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.

similar claimant is .08 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 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 B: 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	.001	-.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)	(.006)
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 C: 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 Injuries Missing Return-to-Work Information			
Incentivized Injuries			
PRE	.495	.508	.428
POST1	.550	.569	.430
POST2	.142	.093	.443
Non-Incentivized Injuries			
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 bonus payment are implemented (1/95-2/97); POST1 refers to the period when the TCMs are in place but the bonus is not (3/97-3/99); and POST2 refers to the period when the TCMs and bonus are in place (4/99-6/02). There are 869,637 observations before the valid return-to-work information criterion is imposed, and 547,096 observations remain after it is imposed.

Appendix D: Probability a Claim Receives Cash Benefits, Linear Probability Model

	(1)	(2)	(3)	(4)	(5)
Sample:	All Injuries	Common Injury Sample	Back Sprains	Bruises (Contusions)	Cuts
POST1	-.005	-.020**	-.027*	-.021**	.011*
	(.005)	(.008)	(.014)	(.007)	(.006)
POST1*INCENT	-.011*	-.017	-.032**	.013**	-.009*
	(.006)	(.014)	(.009)	(.005)	(.005)
POST2	-.010	-.032**	-.052**	-.017*	.009
	(.007)	(.009)	(.007)	(.009)	(.007)
POST2*INCENT	-.015**	-.018	-.033**	.007	-.005
	(.007)	(.015)	(.005)	(.005)	(.004)
Male	-.005*	-.007	-.027**	.004*	.003*
	(.003)	(.006)	(.003)	(.002)	(.001)
Age	.001**	.002**	.003**	.001**	.0004**
	(.0002)	(.001)	(.0004)	(.0001)	(.0001)
Married	-.012**	-.008**	-.016**	-.004**	-.003**
	(.002)	(.003)	(.004)	(.001)	(.001)
Occupation					
Manager	-.041**	-.044**	-.076**	-.022**	-.006*
	(.008)	(.011)	(.006)	(.007)	(.004)
Service Worker	-.009**	-.010**	-.012**	-.014**	-.003
	(.003)	(.002)	(.004)	(.004)	(.002)
Support	-.005*	.00003	.002	-.013**	-.009**
	(.003)	(.0047)	(.005)	(.005)	(.003)
Production	.018**	.025**	.043**	.010*	.007**
	(.004)	(.007)	(.006)	(.005)	(.002)
Laborer	--	--	--	--	--
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