Restricted Work, Workers' Compensation, and Days Away from Work

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ABSTRACT

We use an establishment-based survey of occupational injuries to analyze employers' use of restricted work and its effect on days away from work. Because restricted work provisions vary with the duration and severity of injury, we use its predicted probability in our analysis of days away from work. Higher benefits and lower state waiting periods increase the likelihood of restricted work which substitutes for days away from work especially for hard-to-diagnose injuries. Our results suggest that failure to control for restricted work may yield downward biased estimates of the direct effect of income replacement on work loss.

I. Introduction

The duration of work loss is an important component of the costs associated with work-related injuries. Short-duration injuries are associated with lost productivity and wages; permanent, total disability is associated with a lifelong loss of earning potential. The U.S. workers' compensation system provides benefits to workers injured on the job, regardless of fault, while at the same time protecting employers from further liability and lawsuits. Workers' compensation costs account for a larger share of total hourly benefits than state and federal unemployment benefits combined, and this share has increased from 6.9 percent in 1989 to 8 percent in 1995 (U.S. Bureau of the Census 1994, 1996).

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Anecdotal evidence suggests that the rising cost of workers' compensation has led employers to monitor injured workers and use alternative work arrangements as a way to minimize both the productivity losses associated with injuries, and the effects of moral hazard due to workers' compensation benefits (*Wall Street Journal* 1996). Recent government data on occupational injuries and illnesses is consistent with this trend. The incidence rate for nonfatal injuries with days away from work declined for five years in a row from 1990 to 1995 but rates for injuries with only restricted work rose from 0.7 cases per 100 full-time workers in 1990 to 1.1 cases in 1995 (Bureau of Labor Statistics 1997).

In this paper, we use microdata from the 1993 Annual Survey of Occupational Injuries and Illnesses to study the effect of restricted work arrangements on days away from work resulting from on-the-job injuries. We also study how employers' incentives to provide restricted workdays depend on workers' compensation, firm, and worker characteristics. "Restricted work" in this study refers to practices such as reduced work hours, job modifications, or reassignments that aim to accommodate the physical limitations of injured workers. We believe that higher workers' compensation costs will increase employers' use of restricted workdays especially for those hard-to-diagnose injuries associated with moral hazard.

The analysis of restricted workday provisions and their effects is interesting, given the increasing use of managed care in workers' compensation. For example, by 1998, 65 percent of employers and 61 percent of workers covered by Oregon's workers' compensation laws were covered by managed care organizations. These programs, in addition to reviewing medical services utilization, offer a range of services to promote early return to work for injured workers. They generally feature increased coordination between medical providers and employees in order to provide worker recovery plans aimed at identifying work restrictions and job modifications. Managed care was estimated to reduce work-loss costs by 10 percent in Oregon (Oregon Department of Consumer and Business Services 1999).

Our results show that more generous worker's compensation benefits and lower waiting periods to qualify for benefits lead to a greater likelihood of restricted work. The analysis of work-loss duration shows that restricted work arrangements cause significant reductions in days away from work for back sprains and carpal tunnel injuries. Our results also suggest that analyses that do not control for the provision of restricted workdays yield downward-biased estimates of the direct effects of compensation benefits on days away from work.

Related Literature

Most empirical studies using U.S. data show that the duration of work absences is lengthened by more generous disability benefits. However, the estimated elasticities of work loss with respect to benefits are smaller than analogous measures for unemployment durations (Butler and Worrall 1985; Johnson and Ondrich 1990; Kreuger 1990; Curington 1994; Johnson, Butler, and Baldwin 1995). Leigh (1985) shows that incorporating state fixed effects greatly reduces the magnitude and significance of income replacement effects on the receipt of workers' compensation benefits.

The moral hazard consequences of workers' compensation payments are more evident in studies of benefit effects on the relative frequency and severity of hard-

to-verify injuries such as sprains and strains versus easily observable injuries. Robertson and Keeve (1983), and Butler, Durbin, and Helvacian (1996) show that more generous benefits lead to a greater relative frequency of sprains and strains. Ruser (1998) finds significant effects for carpal tunnel cases, suggesting that workers' compensation may increase incentives for workers to engage in the false reporting of these injuries. Dionne and St. Michel (1991) show that benefit effects on the number of days of workers' compensation are greater for back-related injuries that are harder to diagnose.

Most studies on work-loss durations examine the period of work absence prior to the first return to work. However, Oleinick et al. (1993) found that many workers with compensable claims in Michigan workers' compensation data have anywhere from one to 19 separate episodes of disability following an injury. Butler, Johnson, and Baldwin (1995) point out that almost 60 percent of those who returned to work after a single spell of work loss subsequently had one or more related work absences. They show that the persistence of work-related injuries is related to the provision of accommodations like reduced or light work and modified equipment.

Workplace accommodations range from cheap adjustments like providing antifatigue matting for back sprain cases in an office setting to a more costly provision of lift or tilt tables for injured workers in an industrial setting. According to the Job Accommodation Network, more than half of all accommodations cost more than $500. Alternative estimates reported in Gunderson and Hyatt (1996) place the cost at more than $1,000 per accommodation excluding administrative and managerial costs.[1]

This paper examines the factors affecting the provision of restricted work to workers whose injuries resulted in one or more days away from work. Our theoretical model suggests that the provision of restricted work is endogenous and depends on injury severity among other factors. We also believe that employers' incentives to provide restricted workdays will rise with higher workers' compensation benefits which increase the cost of a given period of work loss, and with shorter waiting periods that increase the length of compensable work loss for a given injury. Finally, our model implies that restricted work may be offered more often to workers with injuries that are prone to moral hazard.

Our work differs from prior research by Butler, Johnson, and Baldwin (1995) on workplace accommodations by focusing on the number of days away from work rather than the probability of return to work. We also account, in our duration model, for endogeneity in the provision of restricted work via a two-stage estimation procedure.

We use microdata from the 1993 Annual Survey of Occupational Injuries and Illnesses focusing on occupational injuries and illnesses with one or more days away from work. Our use of this data set that includes noncompensable injuries distinguishes this study from previous analyses of work loss that relied upon workers' compensation claims data. If workers in the claims data respond differently to com-

1. They show that employers absorb the cost of providing workplace accommodations when injured workers return to their original job but employees pay through lower wages if they change jobs post-injury. However, reductions in physical demands like heavy lifting, bending, and other such physical activities did not come with any drop in wages regardless of whether workers changed jobs or not.

pensation benefits than the average injured worker, then this study may be more representative of the behavior of the average worker.

We study four injury groupings—back sprains/strains, other sprains/strains, fractures of parts other than head or neck, and carpal tunnel cases. Besides being a major injury category in the data, sprains and strains are of interest because the literature cited earlier suggests that moral hazard effects may be more prevalent for them relative to easily observable injuries like fractures. We thus expect the provision of restricted work to be more responsive to workers' compensation costs for sprains relative to the more verifiable injury groups. In addition, our four injury groups are more likely to be compensable than shorter-duration injuries such as cuts and bruises. Thus, it will be easier to see the effects of benefit changes in these groups.

The paper is arranged as follows. Section II describes a theoretical model, Section III describes the data used, Section IV presents the estimating framework, and Section V presents our results. Finally, Section VI consists of a brief discussion and conclusion.

II. The Model

The probability that an injured worker returns to work at time t depends on factors affecting the worker's reservation wage and the wage offer that awaits him/her upon return to work.[2] These variables are likely to be influenced by the extent of the injury, the demographic characteristics of the worker, and the amount of training and firm-specific human capital acquired by the worker. Return to work is also affected by state workers' compensation policies on income replacement and the waiting period, which can affect the cost of recuperation. State policies regarding the worker's choice of doctor can also affect the length of work absence since doctors must attest to the work-relatedness of the injury and workers' ability to resume work.[3] Finally, workers respond to employers' provision of workplace accommodations that make it easier to work in at least a restricted capacity.

In the following model, workers' days away from work are jointly determined with the employers' decision to provide restricted work. The degree of substitution between restricted work and days away from work varies according to the observability of the injury. The provision of restricted work also depends on the duration of work loss. Workers with long duration injuries may be too hurt to perform any kind of work so that restricted work is only feasible for those with less severe injuries. Alternatively, the costs of workplace accommodations may only be outweighed by productivity losses for more serious, long duration injuries.

A. The Duration of Work Loss

Let D_1 represent days away from work for an injured worker who is offered restricted work, D_r be the number of restricted workdays for this worker, and D_0 be the days

2. The probability of a wage offer at the pre-injury workplace is probably close to one since employers who discharge injured workers may leave themselves open to lawsuits and punitive damage claims.

3. Prior research on doctor choice has examined different outcomes like medical costs, the distribution of reported injuries, and the number of days away from work (Durbin and Appel 1991; Ruser 1998; Boden and Ruser 2001).

away from work for a comparable worker without any restricted work days. Thus

$$(1) \quad D_1 = D_1(X, IRR, W); D_0 = D_0(X, IRR, W); D_r = D_r(X)$$

where X represents worker age, demographics, human capital, and job characteristics, IRR represents the income replacement rate—the ratio of total temporary disability benefits ($TTDBEN$) to after-tax wages—received by the worker through workers' compensation, and W represents the state-mandated waiting period before any receipt of benefits.

We assume that compensation benefits affect only the probability of restricted work and the number of days away from work ($\partial D_1/\partial IRR > 0$; $\partial D_0/\partial IRR > 0$). Thus, conditional on restricted work availability, D_r is assumed to be independent of compensation benefits. The effect of W on duration can be positive or negative—a long waiting period may coexist with long durations by discouraging all but the victims of serious injuries to take time off work. Conversely, a short waiting period could prolong the absence of workers with minor injuries by making such injuries eligible for income replacement. However, this negative effect may be smaller under the increased monitoring of a restricted work regime. Thus, we expect that $\partial D_1/\partial W - \partial D_0/\partial W > 0$.

B. The Restricted Work Decision

Employers follow job accommodation strategies designed to promote the quickest return to work possible for the injured worker and thus hold down workers' compensation costs. Their decisions will also depend on the medical doctor's assessment of what and how much work the injured employee is capable of doing. When business is booming, employers will be more proactive about encouraging a quick return to work for injured workers.

Thus, restricted work policies represent a complex amalgam of worker, firm, and state policy characteristics and are dependent on a comparison of its benefits and costs. Let Π_1 represent the firm's profits when it offers injured workers restricted work arrangements, and Π_0 represents profits in the absence of such arrangements. Thus,

$$(2) \quad \Pi_1 = f_1(P, Q) - \gamma \cdot [D_1(X, IRR, W) - W] - \gamma_r(X, E) \cdot D_r(X) - A - u$$

$$\Pi_0 = f_0(P, Q) - \gamma \cdot [D_0(X, IRR, W) - W]$$

$$\gamma = \chi(S) \cdot B(IRR) + \sigma(X, E); \gamma_r = \sigma(X, E)$$

where γ and γ_r represent the cost to the firm per compensable day away from work and per restricted workday respectively, B is the daily benefit paid for every compensable day ($\partial B/\partial IRR > 0$), and $\chi(S)$ represents the fraction of compensation benefits picked up by a firm of size S. The experience rating system places greater weight on the frequency of injuries rather than on their severity when determining workers' compensation premiums. Thus, larger firms pick up a higher proportion of their compensation costs ($\partial\chi/\partial S > 0$) than small firms, which pay premiums that depend more on the average injury experience of similar firms.[4]

4. Statistically, the experience of larger firms with many employees will be more reliable as a measure of prevailing on-the-job risk than the claims experience of smaller firms with few employees.

The fixed costs of restricted work vary randomly across firms and are represented by $A + u$. They include the cost of refitting workstations, providing special tools, or modifying the administrative structure to identify suitable work assignments and monitor accommodations.[5] Worker characteristics, X, also affect the cost-benefit calculations for restricted work. For example, since experienced workers with job-specific skills cannot be easily replaced, firms will be more likely to accommodate them in order to promote their return to work.

Similarly, the level of activity E can affect the dislocation arising from a worker's absence and the likelihood of receiving restricted work. If the firm is working at full capacity, employers are more likely to focus on getting as many workers back on the job as possible. Note that according to our model, E does not have an independent effect on workers' decisions regarding work absence. Instead, workers take their cue from firms' restricted work decisions when deciding how urgently their presence is required. This assumption is key to identifying the coefficients of the duration model.

Employers will decide in favor of restricted work (RW) provisions when they expect their profits to be higher under that regime. Thus,

$$\text{if } f_1 - f_0 + \{\chi(S) \cdot B(IRR) + \sigma(X, E)\} \cdot (D_0 - D_1) - \sigma(X, E) \cdot D_r - A \geq u \text{ then } RW = 1 \quad \text{otherwise } RW = 0$$

According to this straightforward condition, employers will be more likely to offer restricted work when $D_0 - D_1$ is larger, that is, when restricted work is most effective in reducing days away from work from what it would otherwise have been.

According to our model, fixed costs of accommodations will lower the incentive to offer restricted work. Also, if fixed costs are nontrivial, restricted work may be unprofitable to offer to workers with low-cost, short-duration injuries. To see this, note that in the most favorable case where $D_1 = 0$ (where restricted work provisions simply convert a days-away-from-work case to a restricted-work-only case), γD_0 needs to be at least as large as A in order for accommodations to be provided. In less favorable cases where $D_1 > 0$, the disincentive to provide restricted work to shorter duration injuries is even greater.

Our theoretical framework while general, leads to testable hypotheses regarding restricted work provision.

1. Moral Hazard Effects

Restricted work could affect days away from work in the following ways:

$$\text{(a) } D_0 = D_1 + D_r \quad \text{(b) } D_0 > D_1 + D_r \quad \text{(c) } D_0 < D_1 + D_r$$

Under Scenario A, restricted workdays substitute perfectly for days away from work and the injured worker returns to his regular job at the same time that he would have in the absence of restricted work. Under Scenario B, restricted workdays hasten return to the regular job, while in Scenario C, restricted work delays return to the regular job. We interpret Scenario A as approximating the case of little or no moral

5. A quick reading of Return to Work program descriptions turns up a fairly developed monitoring structure with RTW administrators.

hazard—restricted work merely serves to employ the worker in some alternative task more suited to his injured state but does nothing to promote healing. In contrast, Scenario B is consistent with moral hazard—employing the worker in some restricted activity reduces the time to full recovery. This scenario also arises if restricted work hastens healing or reintegration into the work environment. Finally, Scenario C occurs if restricted work actually harms the worker, thus delaying full recovery. Employers should be less likely to offer restricted work under this scenario.

The threshold for restricted work is met more easily under Scenario B than under Scenario A implying that, other things being equal, restricted work should be more likely for hard-to-observe injuries with a greater potential for moral hazard than for verifiable injuries.

2. Compensation Benefit Effects

The sensitivity of restricted work offerings to changes in the replacement rate is given by

$$(D_0 - D_1) \cdot \chi(S) \cdot \partial B/\partial IRR + \gamma(\partial D_0/\partial IRR - \partial D_1/\partial IRR)$$

The second term is more likely to be positive under Scenario B with moral hazard leading to a positive effect of disability benefits on the probability of restricted work.

Note that income replacement has two counteracting effects on days away from work. First, as prior research has shown, an increase in benefits, ceteris paribus, increases days away from work. Second, it increases the probability of restricted work especially for injuries with moral hazard complications, and thus reduces days away from work. The net effect on work loss will depend on the relative strength of these two responses.

Finally, we expect that shorter state waiting periods will increase the incentive to offer restricted work as a way of reducing the number of compensable days since

$$\gamma(\partial D_0/\partial W - \partial D_1/\partial W) < 0$$

3. Firm Size Effects

Larger firms are more likely to offer restricted work schedules since

$$(D_0 - D_1) \cdot B(IRR) \cdot \partial\chi/\partial S \geq 0$$

Larger firms with more injuries face premiums that are closely tied to their actual injury experience. Thus, they are expected to be more vigilant in controlling their injury costs by promoting return to work and reducing the number of compensable injuries.

III. The Data

The Annual Survey of Occupational Injuries and Illnesses is a federal/state program that has collected occupational injury and illness data on an annual basis since 1972, from logs that employers maintain according to Occupational

Safety and Health Administration (OSHA) guidelines. In 1993, employer reports of worker injuries were collected from about 250,000 private industry establishments. These establishments reported on the numbers of injuries and illnesses of various types (without lost work, with only restricted-work days, or with days away from work) that occurred in the previous year. Since 1992, the summary data for each establishment were supplemented by case and demographic data from OSHA logs for injuries and illnesses that involved one or more days away from work.[6]

This paper focuses on the data for days-away-from-work cases in 1993. Note that these cases may or may not involve restricted work arrangements. These cases are also distinct from restricted-work-only cases that do not involve any days away from work. While the increasing use of workplace accommodations may cause cases to move from the days-away-from-work category into the restricted-work-only category, we cannot address this shift because of the lack of detailed worker-level information for the latter category. Thus, our results provide a partial look at the effects of restricted work arrangements on days away from work.

The 1993 case and demographic data consist of 603,936 cases representing 2.25 million injuries and illnesses with days away from work. It excludes work fatalities and nonfatal work injuries and illnesses to the self-employed; to workers on farms with fewer than 11 employees; to private household workers; and to employees in federal, state, and local governments.

The data contain information on age, sex, race, length of service at the establishment, and occupation as well as injury characteristics like the nature, source, event, and body part for each case with days away from work. The number of restricted workdays was reported for workers whose recovery involved restricted work arrangements. When combined with the summary data, our final dataset includes information on establishment characteristics like state, industry, average employment, and annual hours worked by all employees.

Employers' reports of work loss followed recordkeeping guidelines issued by OSHA (Bureau of Labor Statistics 1986).[7] Multiple absences associated with the same injury were combined to yield the total days away from work attributable to a given injury. Thus, the Survey data do not allow us to gauge the effect of restricted work arrangements on first spells of work loss separately from repeat spells for the same injury.

Employers in the Survey lacked explicit instructions for counting lost workdays.[8] For those workers who had not returned to work by the end of the survey year, reported days away from work were likely to be censored. However, unambiguous

6. Establishments expected to have 20 or fewer cases with days away from work were required to report on each case though firms expected to have larger numbers of such cases were to sample those cases.

7. According to the guidelines, employers were expected to enter the number of work loss days in the OSHA log within six days of the injury date and to estimate the number of days if the employee was still injured or ill when the entry was made. When the employee returned, the employer was expected to update the entry of days away from work even if the return occurred in the next calendar year.

8. When estimating annual totals for all injury cases, the employers were to estimate the future number of lost workdays and add that estimate to the workdays already lost (see Bureau of Labor Statistics 1986). Extensive record-keeping guidelines state that lost workdays should be estimated and counted even if they continue into the next year. However, no instructions to guide this estimation were provided calling into question the reliability of the work loss estimates for open cases.

identifiers were not available for these spells.[9] To identify censored cases, we added the number of reported lost days away from work to the injury date. If the implied return date was later than the date the employer signed the report prior to filing it, we treated the case as censored. For cases with faulty signing dates but which had implied return dates in 1994, we calculated work-loss duration as the difference between January 1, 1994, and the injury date in 1993 and classified the case as censored. Cases with implied return dates in 1993 were treated as complete and uncensored.

Employers reported the number of restricted workdays for those days-away-from-work cases involving restricted work arrangements. The Survey follows the OSHA definition of restricted work—reduced work hours for the injured worker, job modifications to involve fewer activities that may exacerbate injuries (for example, less lifting for workers with back injuries or less typing for workers with carpal tunnel syndrome), or temporary transfers to another job. The Survey does not distinguish between these different methods of accommodating workers.

We focus on the relationship between restricted work provision and the potential for moral hazard by creating a dummy variable for the provision of restricted workdays equal to one (zero) if a positive (missing) number of restricted workdays are reported. For injuries with moral hazard, we can reasonably expect that the mere fact of monitoring and follow-up associated with restricted work may be just as important in its effect on days away from work if not more so, than the number of days of restricted work.

Since the Survey does not carry any information on workers' compensation benefits in different states, we added this information from other sources. Specifically, we added the waiting period required by each state to qualify for compensation from the 1992 Analysis of Workers' Compensation Laws prepared by U.S. Chamber of Commerce. We also calculated the weekly benefit for total temporary disability cases as well as the net average weekly wage by state, age, sex, and occupation.[10] We merged the data on benefits and wages for different state, age, occupation, and sex categories with the cases in the Annual Survey.

The compensation benefits and wage data were calculated only for 18–64 year olds in state, age, occupation, and sex groups with adequate sample size in the CPS. Thus, we restricted the injury sample to 18–64 year olds and dropped cases for which we did not have information on these variables. Cases for whom injury reports were signed later than October 1994 were discarded (since the 1993 Survey was frozen in October 1994), as were those with missing injury dates. Cases with injury dates in November and December of 1993 were also excluded from the analysis, as there appeared to be a large drop in injury duration for long duration injuries that

9. The employer was asked if the worker had not yet returned to "regular work" in 1993 and, if so, when was the expected return date, leaving open the possibility that workers who were restricted in their work also would be associated with a positive response to this question.

10. For each observation with a weekly earnings value in the CPS microdata, the weekly temporary total disability was calculated using the 12 monthly microdata files of the Current Population Survey and the state laws governing the payment of temporary total disability benefits. Since workers' compensation benefits are not taxed, net average weekly wages were calculated by multiplying the weekly wage by one minus 0.28 minus the states' marginal tax rate for workers with the state's median family income. For more details, see Ruser (1998).

occurred in this period.[11] We also drop two very large firms with more than 30,000 employees from our analysis in order to reduce the heterogeneity in firm types.

Finally, to focus on injuries of similar severity we excluded workers with permanent total disabilities from our analysis of short-term disability loss. These workers are likely to be less responsive to changes in workers' compensation benefits or job accommodations than those with temporary total disabilities on whom this paper is focused. Since the Survey does not report on whether the injury involved permanent total disability, we assume that all such cases would be censored. We then use an appropriately adjusted probability of permanent total disability given work loss to randomly exclude some of the censored cases from the estimation of short-term work loss.[12]

Since there were very large numbers of sprains and strains and fractures, we randomly sampled 10 percent of sprains and 25 percent of fractures, while including all of the carpal tunnel cases. Our final sample is composed of 11,524 back sprains and strains, 11,208 cases of other sprains and strains, 6,947 carpal tunnel cases, and 6,448 fractures (not of head or neck).

IV. The Estimating Framework

The correlations between restricted work and the duration of work loss for injuries of varying severity will yield biased estimates of their relationship for a more homogenous group of injuries. We correct for the endogenous provision of restricted work by using a two-stage estimation procedure. We use a probit equation in the first stage to predict the probability of restricted workdays and then use this predicted probability as a regressor in a Weibull duration model for days away from work. Our identification strategy depends on finding variables that are significant predictors of restricted work but that do not independently affect the number of days away from work. While our theoretical model implied different duration equations for those with and without restricted work, in the empirical work that follows, we make the simplifying assumption that restricted work causes a shift in the duration equation and does not change the effects of other variables in the model.

11. For example, although the median days away from work is 30 for all carpal tunnel syndrome cases occurring in the first half of the year, that number dropped to 22 in the last quarter. Similarly, the median for all fractures drops from 21 days for those occurring in the first quarter to 17 days in the last quarter, while that for amputations drops from 25 to 17 days. The declines are clearly centered in November and December although the October medians for these cases appear to be close to or equal to the full year medians. The declines could occur due to error in the reports of work loss due to censoring. Also, the last two months of the year involve a higher number of holidays than in previous months and these are not included in the count of days away from work.

12. We used the Detailed Claims Information database on a nationally representative sample of workers' compensation lost workday claims spanning 16 states for 1979–88 to calculate the following probability:

$$Pr(PT \mid censor = 1) = Pr(PT \text{ in } DCI) \cdot \frac{\#> = 4 \text{ days in Survey}}{\#\text{ censored in Survey}}$$

(DCI cases, on average, incur four or more days of work loss in order to qualify for workers' compensation benefits.) The above expression is calculated by injury type to yield a percentage of censored cases that can be treated as permanently, totally disabled and which are then randomly excluded from the estimation of short-term work loss.

The model outlined in Section II showed the restricted work decision to be a function of worker and injury characteristics, factors like firm size, and experience rating that affect the firm's cost per compensable day away from work, the level of economic activity at each firm, and state level workers' compensation variables. Assume that the stochastic component of accommodation costs, u, follows a standard normal distribution. In the first stage, we predict the probability of restricted workdays using a simple univariate probit model given by

$$\Pr(\textit{Restricted Work}) = \Phi(R_r\beta)$$

where Φ is the cumulative standard normal distribution function. R_r is a vector of regressors such as age, race, sex, injury characteristics, tenure with the current employer, industry, occupation and the average weekly wage associated with each worker. Since we expect the provision of restricted workdays to vary with workers' compensation characteristics, R_r also includes weekly temporary disability benefits, *TTDBEN* (which together with the weekly wage determines the income replacement rate *IRR*), and state waiting periods.

We also include average reported employment and the rate of days-away-from-work cases at the establishment level to control for the effect of work injuries on a firm's workers' compensation costs. The days-away rate is calculated as the total number of injuries and illnesses with days away from work divided by the reported employment in each establishment. These two variables together help to control for the effects of firm size and injury record due to experience rating.[13] The rate of cases with days away from work also helps to control for the riskiness of work in each establishment as well as capture an additional source of variation in the cost of providing workplace accommodations. While a higher rate may decrease the fixed cost of providing restricted work to an injured worker, it may increase the problem of reallocating work among remaining workers and of monitoring such arrangements.

Previous studies have shown a positive association between union membership and workers' compensation claims rates (Butler and Worrall 1983; Kreuger and Burton 1990; Hirsch, Macpherson, and Dumond 1997). Union membership also may affect employers' incentives to use restricted work as a means of controlling their claims. We thus include the state union membership rate in the probit model.

Finally, in order to control for changes in economic activity at each firm that may alter the likelihood of restricted work provisions, we include the ratio of the annual hours worked in each firm divided by the full-time hours that would be associated with each establishment's workforce. Whether this ratio is less than or greater than one indicates the extent to which the establishment's workforce is fully employed. As mentioned earlier, this variable is key to identifying the coefficients of the duration model.

Assuming that the hazard rate varies over time, the duration of work loss is assumed to follow a Weibull distribution. A potential problem with the standard Wei-

13. The firms in our sample will primarily differ in the degree of experience rating. According to Worrall and Butler (1988), in 1980, a firm with any more than three employees in the manufacturing sector was likely to be experience rated—approximately 15 percent of firms (with 90 percent of employees) are experience rated to some degree. However, those with fewer than 1,000 employees are probably not fully experience rated.

bull specification is unobserved heterogeneity across different individuals that could induce a false negative duration dependence.[14] If the duration distribution is assumed to be homogenous across individuals when it is not, it could result in inconsistent parameter estimates or incorrect standard errors. Therefore we incorporate heterogeneity into the Weibull model by introducing individual-specific heterogeneity effect v into the survival function where v is a realization of the random variable V. V is assumed to be distributed according to a gamma distribution with mean one and variance $\theta = 1/k$.[15] The unconditional survival function $S(t)$ and the corresponding hazard function for this model are given by[16]

$$S(t) = [1 + \theta(\lambda t)^{\alpha}]^{-1/\theta}$$

$$\Lambda(t) = \lambda\alpha(\lambda t)^{\alpha-1}S(t)^{\theta}$$

In order to allow for measured differences between individuals to affect the duration, a vector of time-invariant regressors, R_d, is introduced into the hazard function by specifying $\lambda = \exp(-R_d\omega)$. Besides the predicted probability of restricted work, the vector R_d includes the same variables used in R_r excluding the measure of economic activity for each establishment. We believe that while this may affect the likelihood of an injury, it should not affect the duration of a given injury, except indirectly via its effect on the provision of restricted workdays. Thus, variations in economic activity across firms and the nonlinear functional form for the probability of restricted work serve to identify the second-stage regression.

Since weekly wages and workers' compensation benefits are imputed and thus measured with error, the estimated relationship between benefits and restricted work or days away from work may be downward biased. Yet, as Ruser (1998) points out, we may not want to use information on benefits and wages for injured workers even if they were available due to the potential for selection bias. If workers' compensation is associated with moral hazard, then those with more days away from work are also likely to have lower weekly wages associated with higher replacement rates (benefits are capped). Thus, it is preferable to use the average wage replacement rate for all workers, not just injured ones, similar to the injured worker. Finally, to the extent that we have not fully controlled for differences in injury severity, our estimates of the substitution between restricted work days and days away from work may be biased.

14. Intuitively, if the workers in the sample are of two types—one type whose injuries and unobserved characteristics promote an earlier return to work than the other type—then the apparently falling hazard over time may be simply the result of the first group exiting the injury state earlier. Thus, the survivors increasingly consist of people with lower but time-invariant chances of leaving the state to begin with. The hazard for each of the two groups may not have negative duration dependence, yet their mixture falsely induces such a relationship.

15. Butler and Worrall (1991) estimate gamma duration models without explicitly specifying a parametric distribution for unobserved heterogeneity. They find that though controlling for heterogeneity is important, both parametric and nonparametric controls perform equally well.

16. Note that the greater the variance of v, the larger the effect of individual-specific heterogeneity relative to the standard Weibull model. The limiting case when $\theta = 0$ (V is at its unit mean) in Equation 4 yields the standard Weibull model with no heterogeneity described in Equation 2.

Table 1
Descriptive Statistics by Injury

Variable	Back Sprains N = 11,524	Other Sprains N = 11,208	Fractures[a] N = 6,448	Carpal Tunnel N = 6,947
Age (percent)				
18–24 years old	0.16	0.17	0.15	0.07
25–34 years old	0.36	0.33	0.28	0.28
35–44 years old	0.28	0.28	0.27	0.34
45–54 years old	0.15	0.16	0.19	0.23
55–64 years old	0.05	0.06	0.11	0.08
Female (percent)	0.30	0.33	0.21	0.72
Tenure with current firm (percent)				
1–3 months	0.10	0.12	0.13	0.04
4–11 months	0.17	0.16	0.16	0.09
1–5 years	0.34	0.33	0.31	0.31
>5 years	0.31	0.30	0.33	0.47
Firm size (percent)				
<13 workers	0.02	0.02	0.04	0.003
13–49 workers	0.11	0.11	0.16	0.03
50–99 workers	0.16	0.15	0.17	0.08
100–249 workers	0.30	0.29	0.28	0.25
250–499 workers	0.18	0.19	0.17	0.25
500–999 workers	0.10	0.11	0.09	0.19
1,000–2,499 workers	0.09	0.09	0.07	0.14
>2,499 workers	0.04	0.04	0.03	0.06
Industry (percent)				
Agriculture	0.02	0.03	0.03	0.01
Mining	0.02	0.02	0.04	0.002
Construction	0.10	0.10	0.19	0.02
Manufacturing	0.35	0.33	0.36	0.71
Transportation	0.09	0.11	0.08	0.04
Wholesale sales	0.06	0.06	0.06	0.03
Retail sales	0.12	0.11	0.09	0.07
Finance, insurance, real estate	0.02	0.02	0.02	0.04
Occupation (percent)				
Professional/specialist	0.03	0.03	0.02	0.01
Management/executive	0.01	0.01	0.02	0.02
Technical	0.03	0.03	0.02	0.02
Sales	0.05	0.05	0.04	0.03
Administrative	0.06	0.06	0.05	0.15
Protective services	0.004	0.01	0.01	0.003

Table 1 (*continued*)

Variable	Back Sprains N = 11,524	Other Sprains N = 11,208	Fractures[a] N = 6,448	Carpal Tunnel N = 6,947
Other services	0.15	0.14	0.08	0.04
Farming	0.02	0.03	0.03	0.005
Craft—mechanical	0.05	0.05	0.07	0.03
Craft—construction	0.07	0.07	0.13	0.02
Craft—precision	0.04	0.04	0.04	0.08
Operator	0.19	0.19	0.20	0.46
Mover	0.10	0.12	0.12	0.02
Handler	0.18	0.17	0.18	0.11
Median days from work	6	6	21	34
Restricted work (percent)	0.23	0.21	0.25	0.38
Proportion of restricted work cases by duration of work loss				
<Median work loss	0.24	0.19	0.31	0.43
>Median work loss	0.23	0.23	0.19	0.33
Proportion of restricted work cases by state waiting period				
Wait = three days	0.28	0.24	0.28	0.42
Wait = five days	0.19	0.21	0.22	0.32
Wait = seven days	0.21	0.19	0.23	0.36

a. Excludes head or neck fractures.

V. Results

Table 1 presents characteristics of selected variables used in our analysis by injury category (complete results are available from the authors on request). Workers with carpal tunnel syndrome were more likely to be over 35 years of age and were overwhelmingly female relative to those with other injuries. They were also more likely to have longer job tenure, to work in larger firms, and to be employed as operators or in administrative positions. Workers with fractures were almost twice as likely to be employed in the construction industry as those with sprain and strain injuries who were more likely to be employed in service industries.

The bottom half of Table 1 shows median durations and the distribution of restricted workdays by duration and waiting period. For back sprains, there was no significant difference in restricted workdays for injuries of different durations. For other sprains and strains, longer duration injuries were more likely to be associated with restricted work. Restricted workdays were more prevalent for shorter carpal tunnel and fracture cases, suggesting that they may shift the distribution of days

away from work toward shorter durations for these injuries. Alternatively, those with more severe cases of these injuries may not be able to perform any kind of work. This pattern in restricted work usage was consistent with the relative severity of fractures and carpal tunnel cases with median work loss of 21 and 34 days, respectively, relative to sprains and strains with a median work loss of six days.

Table 1 shows that shorter state waiting periods to qualify for income replacement are associated with higher use of restricted work. States with five- or seven-day waiting periods were less likely to observe restricted workdays than states with three-day waits. Since states with shorter waiting periods were more likely to have compensable injuries, this pattern suggests that firms may be using restricted work to control workers' compensation costs.

A. Probability of restricted workdays

Tables 2–5 present the results from the first-stage reduced-form estimation of the probability of receiving restricted workdays, for each of the four injury categories (complete results are available from the authors on request). We believe that higher benefits will increase employers' incentives to offer restricted work schedules to a larger pool of injured workers than they might otherwise have especially for hard-to-observe injuries.[17] In addition, they may prompt large, experience-rated employers to offer restricted workdays more often so as to avoid any premium hikes resulting from having more compensable work loss. We examine this issue in more detail by estimating models separately for large and small firms.

To facilitate comparison with other research using workers' compensation data, we also present results for a smaller sample of potentially compensable cases whose days away from work are longer than their state waiting periods. Note that while our theoretical model referred to the income replacement ratio, we separate out the components of this ratio, the weekly temporary disability benefit (*TTDBEN*) and the net weekly wage in our empirical work to allow these two variables to have different effects.

Controlling for differences in the waiting period and worker, injury, and establishment characteristics, higher weekly benefits were positively related to the probability of working on a restricted schedule for sprains, strains, and carpal tunnel cases though the effect was strongest for back sprains. For fractures, higher benefits reduced the probability of restricted work but this effect was statistically insignificant. The effect of weekly benefits was larger for compensable cases of all injuries except other sprains.[18]

Controlling for differences in weekly benefits, longer waiting periods significantly reduced the likelihood of receiving restricted workdays for all the injury types including fractures, and for small and large firms. This was consistent with employers' efforts to control their workers' compensation costs by reducing the likelihood that their injured workers would qualify for benefits. These efforts would be more likely in states with shorter waiting periods that made it easier for injuries to qualify for

17. Note that in our data, the weekly benefit has been calculated by state, age, occupation, and sex, and may therefore vary even among workers in the same state.

18. This can be seen more easily from the top panel of Table 7.

Table 2
Univariate Probit Estimates of Restricted Workday Provisions—Back Sprains[a] *(Standard errors in parentheses)*

Variable	All N = 1,1524 (1)	250 or Fewer Workers N = 6,771 (2)	More than 250 Workers N = 4,753 (3)	Compensable Cases N = 6,151 (4)
Average reported employment				
<=12	0.522*** (0.105)	0.454*** (0.108)	—	0.579*** (0.134)
13–50	0.093* (0.051)	0.068 (0.052)	—	0.117* (0.068)
51–100	−0.009 (0.043)	−0.016 (0.043)	—	0.075 (0.058)
251–500	0.037 (0.040)	—	—	0.079 (0.055)
501–1,000	0.176*** (0.049)	—	0.115** (0.052)	0.185*** (0.067)
1,001–2,500	0.274*** (0.057)	—	0.214*** (0.061)	0.253*** (0.078)
2,501–30,000	0.182** (0.078)	—	0.111 (0.083)	0.065 (0.107)
State union rate	−3.242*** (0.335)	−2.860*** (0.449)	−3.626*** (0.514)	−2.962*** (0.471)
Days-away-from-work rate	−1.625*** (0.227)	−1.269*** (0.249)	−3.573*** (0.568)	−1.415*** (0.311)
Log activity	0.097 (0.062)	0.090 (0.079)	0.122 (0.100)	0.019 (0.084)
State waiting period	−0.068*** (0.008)	−0.063*** (0.010)	−0.077*** (0.012)	−0.054*** (0.010)
TTDBEN/100	0.223*** (0.044)	0.235*** (0.060)	0.207*** (0.066)	0.262*** (0.060)
Average net weekly wage	−0.101*** (0.034)	−0.091** (0.046)	−0.123** (0.051)	−0.132*** (0.047)

a. Other covariates include age, sex, race, tenure, event and body part of injury, 13 occupation groupings, and detailed industry categories.

Table 3
Univariate Probit Estimates of Restricted Workday Provisions—Carpal Tunnel Syndrome[a] *(Standard errors in parentheses)*

Variable	All N = 6,947 (1)	250 or Fewer Workers N = 2,533 (2)	More than 250 Workers N = 4,414 (3)	Compensable Cases N = 6,194 (4)
Average reported employment				
<=12	0.587** (0.291)	0.319 (0.302)	—	0.531* (0.294)
13–50	−0.052 (0.100)	−0.137 (0.104)	—	−0.025 (0.105)
51–100	−0.174*** (0.067)	−0.201*** (0.068)	—	−0.182*** (0.071)
251–500	0.114** (0.045)	—	—	0.122** (0.048)
501–1,000	0.178*** (0.049)	—	0.061 (0.049)	0.201*** (0.053)
1,001–2,500	0.252*** (0.058)	—	0.139** (0.058)	0.247*** (0.062)
2,501–30,000	0.168** (0.078)	—	0.059 (0.079)	0.124 (0.084)
State union rate	−2.221*** (0.394)	−1.245* (0.673)	−2.805*** (0.497)	−2.330*** (0.420)
Days-away-from-work rate	−3.406*** (0.432)	−2.175*** (0.532)	−5.589*** (0.736)	−2.955*** (0.447)
Log activity	0.177* (0.094)	0.058 (0.144)	0.289** (0.129)	0.173** (0.099)
State waiting period	−0.066*** (0.009)	−0.059*** (0.015)	−0.071*** (0.012)	−0.069*** (0.009)
TTDBEN/100	0.089 (0.060)	0.172* (0.106)	0.026 (0.074)	0.124* (0.065)
Average net weekly wage	−0.054 (0.047)	−0.065 (0.083)	−0.031 (0.058)	−0.052 (0.051)

a. Other covariates include age, sex, race, tenure, event, and body part of injury, 13 occupation groupings, and detailed industry categories.

Table 4

Univariate Probit Estimates of Restricted Workday Provisions—Other Sprains[a] *(Standard errors in parentheses)*

Variable	All N = 11,208 (1)	250 or Fewer Workers N = 6,459 (2)	More than 250 Workers N = 4,749 (3)	Compensable Cases N = 5,882 (4)
Average reported employment				
<=12	0.283*** (0.109)	0.217* (0.112)	—	0.332** (0.144)
13–50	0.119** (0.059)	0.089* (0.055)	—	0.145** (0.072)
51–100	−0.012 (0.045)	−0.025 (0.046)	—	−0.038 (0.063)
251–500	0.059 (0.041)	—	—	0.110** (0.056)
501–1,000	0.099** (0.049)	—	0.027 (0.053)	0.167** (0.066)
1,001–2,500	0.131** (0.055)	—	0.078 (0.061)	0.250*** (0.074)
2,501–30,000	0.161** (0.076)	—	0.085 (0.081)	0.251** (0.104)
State union rate	−3.287*** (0.349)	−3.486*** (0.479)	−2.985*** (0.522)	−3.276*** (0.493)
Days-away-from-work rate	−1.919*** (0.234)	−1.563*** (0.259)	−3.313*** (0.547)	−1.693*** (0.306)
Log activity	0.076 (0.059)	0.085 (0.081)	0.034 (0.088)	0.214*** (0.079)
State waiting period	−0.063*** (0.008)	−0.066*** (0.012)	−0.060*** (0.012)	−0.052*** (0.011)
TTDBEN/100	0.079* (0.046)	0.045 (0.062)	0.115* (0.070)	0.039 (0.062)
Average net weekly wage	−0.027 (0.035)	−0.015 (0.046)	−0.036 (0.053)	−0.023 (0.048)

a. Other covariates include age, sex, race, tenure, event, and body part of injury, 13 occupation groupings, and detailed industry categories.

Table 5
Univariate Probit Estimates of Restricted Workday Provisions—Fractures[a] (Standard errors in parentheses)

Variable	All N = 6,448 (1)	250 or Fewer Workers N = 4,154 (2)	More than 250 Workers N = 2,294 (3)	Compensable Cases N = 4,761 (4)
Average reported employment				
<=12	0.452*** (0.112)	0.378*** (0.116)	—	0.374*** (0.131)
13–50	0.152*** (0.059)	0.119** (0.060)	—	0.155** (0.069)
51–100	−0.002 (0.056)	−0.014 (0.057)	—	0.014 (0.067)
251–500	0.108** (0.054)	—	—	0.101 (0.065)
501–1,000	0.167** (0.069)	—	0.041 (0.074)	0.191** (0.083)
1,001–2,500	0.178** (0.080)	—	0.076 (0.087)	0.107 (0.098)
2,501–30,000	0.350*** (0.118)	—	0.246** (0.125)	0.357*** (0.138)
State union rate	−2.470*** (0.439)	−2.945*** (0.578)	−1.576** (0.700)	−2.659*** (0.536)
Days-away-from-work rate	−2.368*** (0.324)	−1.971*** (0.348)	−4.479*** (0.862)	−2.032*** (0.375)
Log activity	0.165** (0.073)	0.108 (0.091)	0.267** (0.134)	0.185** (0.086)
State waiting period	−0.064*** (0.010)	−0.058*** (0.013)	−0.076*** (0.017)	−0.073*** (0.012)
TTDBEN/100	−0.017 (0.054)	0.067 (0.069)	−0.130 (0.091)	0.034 (0.065)
Average net weekly wage	0.009 (0.039)	0.003 (0.049)	−0.014 (0.066)	0.001 (0.048)

a. Other covariates include age, sex, race, tenure, event, and body part of injury, 13 occupation groupings, and detailed industry categories.

workers' compensation. The persistence of these strong negative effects for compensable cases in Column 4 may be more reflective of the greater severity of such cases in states with longer waiting periods, making any kind of return to work less likely for them.

The coefficients on establishment size in Column 1 of Tables 2–5 show that workers in firms with more than 250 employees were significantly more likely to have restricted workdays than smaller firms, with larger effects for larger firms. Firms with less than 12 employees appeared to be similar to larger firms in their use of restricted work. These size effects may reflect the effect of experience rating in the workers' compensation system that links larger firms' premiums more closely with their actual injury experience. Thus, larger firms would be more inclined to use restricted work to reduce the size of their workers' compensation claims. Large firms may also be more likely to have light duty jobs that lend themselves easily to restricted work arrangements. The substitution of restricted work for work-loss days also may be common for very small firms who cannot afford to hire and train temporary replacement workers.

We explore differences by firm size more fully in Columns 2 and 3 where we present estimates from separate models for firms with less or more than 250 employees. Weekly benefits were statistically significant for small firms in carpal tunnel cases, and for large firms in cases involving other sprains and strains. Only for back sprains did weekly benefits maintain their statistical significance for both size categories. This result is puzzling since we expected stronger benefit effects for larger firms. However, the pattern of injuries for which benefits had positive effects suggests that employers had a greater incentive to offer restricted workdays as a monitoring tool for hard-to-verify injuries with the greatest potential for moral hazard while observable injuries like fractures were less likely to be associated with restricted work.

The coefficient on our measure of economic activity in each establishment showed that for all four injury categories, the greater the proportion of fully employed workers, the more likely workers were to receive restricted work. Employers might have been more anxious to get their injured workers back on the job when the work load was high, and the benefits of their restricted work abilities outweighed the costs of their alternative work arrangements.

Restricted work arrangements were more likely in firms with better injury records. Workers in firms with a higher days-away injury rate were less likely to experience restricted work for sprains, carpal tunnel, and fractures. This negative effect of the injury rate appeared stronger for firms with more than 250 workers. If our two-digit industry dummies did not fully control for the within-industry variation in injury rates, the negative effect of the injury rate might reflect industry-level differences. Firms with a high rate of days-away-from-work cases have tended to be in the mining, manufacturing, or transportation industry groups (Bureau of Labor Statistics 1996). Jobs in these industries are likely to be more physically demanding and hence may require costlier accommodations than in industries with lower injury rates.

The state union membership rate had a strongly negative effect on the likelihood of restricted work for all four injury categories. As suggested by Hirsch, Macpherson, and Dumond (1997), unionized workers may receive more guidance from their union representatives and be better protected against employer monitoring and penalties for filing claims.

Among other variables whose coefficients are not reported here, there was a slight pattern in favor of longer tenure workers being more likely to receive restricted work. Controlling for tenure, the probability of receiving restricted workdays decreased with age though this effect was statistically significant only for carpal tunnel cases. Our results suggest that injuries to older workers caused greater reductions in their ability to perform any work, reducing the net benefit of restricted work schedules. Finally, women were significantly more likely to receive restricted work than men for all types of sprains and strains; there was no single pattern of race differences across the injury types.

To summarize, our probit results show that higher disability benefits increased the use of restricted work for three out of four injury types, though some effects were statistically insignificant when small and large firms were analyzed separately. As predicted by our model, benefit effects were greatest for back sprains, which are more subject to moral hazard issues than other injuries (Robertson and Keeve 1983; Dionne and St. Michel 1991; Butler, Durbin, and Helvacian 1996; Ruser 1998). Longer state waiting periods uniformly reduced the likelihood of restricted work provisions.

B. Results from the Duration Model

In Table 6, we present the coefficients of selected variables from our Weibull duration model with gamma distributed heterogeneity. As stated earlier, the second stage duration equation is identified by both variations in economic activity across firms and the nonlinearity of the predicted probability of restricted work. Thus we are restricting the level of activity to have no effect on injury severity. Our model also assumes that workers do not respond directly to the activity level when deciding how long to stay away from work. Instead, they look to firms to signal how urgently their presence is required via restricted work provisions. Likelihood ratio tests show that our identifying assumptions cannot be rejected at standard levels of significance.

Columns 1–2 show results when our model is estimated for all cases regardless of their compensability. Columns 3–4 report results for these cases by firm size. Columns 5–6 show estimates when our sample is restricted to compensable cases defined as cases with days away from work greater than the state waiting periods. Since the standard errors will be downward biased in the models using the predicted value of the restricted work provisions, we report bootstrapped standard errors.[19]

We expect that, controlling for differences in severity, cases associated with restricted workdays will have shorter durations of work loss especially for injuries with potential for moral hazard complications. We also expect higher temporary disability benefits to be associated with more days away from work. As stated earlier, longer waiting periods may increase or decrease the number of days away from work.

Our duration models differ from those in the literature because of our control for restricted work provisions. As such, the coefficient on compensation benefits in Columns 2, 3, 4, and 6 indicates the direct effect of benefits on days away from work, while the coefficients in Columns 1 and 5 indicate the total effect of benefits

19. Due to software restrictions regarding the sampling with replacement procedure, we bootstrapped standard errors with 80 percent of the sample of sprains and strains for Column 2.

Table 6

Effects of Selected Variables on Log Days Away from Work[a] (Standard errors in parentheses)

	Benefits/100 Full Sample		Firm Size ≤ 250	Firm Size > 250	Compensable Cases Ln(Covered Days)	
	Ln(Days Away from Work)					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Back sprains						
State union rate	0.387 (0.275)	−1.229 (0.901)	−0.471 (0.973)	0.589 (1.193)	0.388 (0.491)	0.414 (1.331)
Days-away-from-work-rate	−0.401** (0.165)	−1.061*** (0.379)	−0.742** (0.375)	0.151 (1.125)	−0.100 (0.319)	−0.089 (0.617)
State waiting period	0.009 (0.006)	−0.025 (0.022)	−0.013 (0.021)	0.021 (0.026)	0.176*** (0.011)	0.177*** (0.027)
TTDBEN/100	0.054 (0.036)	0.162** (0.072)	0.119 (0.092)	0.015 (0.078)	0.121* (0.063)	0.119 (0.133)
Average net weekly wage	0.007 (0.027)	−0.038 (0.041)	0.003 (0.051)	0.001 (0.057)	−0.021 (0.048)	−0.019 (0.083)
Restricted work	—	−1.736** (0.864)	−0.704 (1.047)	−0.147 (1.015)	—	0.031 (1.489)
Carpal tunnel						
State union rate	0.452 (0.319)	−0.384 (0.686)	−0.524 (0.996)	−1.091 (1.091)	0.359 (0.332)	−0.718 (0.732)
Days-away-from-work rate	1.044*** (0.312)	−0.684 (0.814)	−1.981** (0.941)	0.119 (2.013)	1.071*** (0.315)	−0.773 (0.802)
State waiting period	0.052*** (0.007)	0.009 (0.021)	−0.034 (0.031)	0.026 (0.027)	0.052*** (0.008)	0.008 (0.021)
TTDBEN/100	0.039 (0.045)	0.156** (0.071)	0.275* (0.155)	0.024 (0.076)	−0.034 (0.049)	0.089 (0.077)
Average net weekly wage	0.015 (0.037)	−0.061 (0.053)	−0.127 (0.109)	0.053 (0.059)	0.066* (0.039)	0.019 (0.056)
Restricted work	—	−1.541** (0.740)	−3.968*** (1.337)	1.007 (0.961)	—	−1.866** (0.789)
Fractures						
State union rate	1.111*** (0.406)	0.215 (0.805)	1.259 (1.088)	−1.103 (1.006)	0.688 (0.435)	0.349 (0.785)
Days-away-from-work rate	0.447* (0.235)	−0.207 (0.527)	0.271 (0.592)	−1.743 (1.234)	0.430* (0.235)	0.235 (0.515)
State waiting period	0.019** (0.009)	−0.004 (0.020)	0.003 (0.023)	−0.022 (0.029)	0.041*** (0.010)	0.032* (0.019)
TTDBEN/100	0.017 (0.051)	0.007 (0.057)	0.058 (0.072)	−0.223* (0.125)	−0.018 (0.054)	−0.015 (0.054)
Average net weekly wage	−0.039 (0.037)	−0.034 (0.042)	−0.072 (0.047)	0.074 (0.085)	−0.035 (0.039)	−0.034 (0.041)
Restricted work	—	−1.211 (0.861)	−0.300 (1.212)	−2.752*** (0.934)	—	−0.453 (0.891)
Other Sprains						
State union rate	0.561* (0.291)	0.147 (0.868)	0.008 (0.948)	2.147** (0.990)	−0.639 (0.481)	−0.417 (0.906)
Days-away-from-work rate	−0.278* (0.166)	−0.463 (0.427)	−0.305 (0.367)	0.443 (0.932)	−0.026 (0.249)	0.044 (0.363)
State waiting period	−0.002 (0.007)	−0.009 (0.020)	−0.016 (0.019)	0.039* (0.022)	0.117*** (0.011)	0.121*** (0.017)
TTDBEN/100	−0.006 (0.039)	0.003 (0.055)	−0.015 (0.063)	−0.019 (0.082)	−0.054 (0.061)	−0.056 (0.076)
Average net weekly wage	−0.009 (0.028)	−0.012 (0.037)	0.015 (0.041)	−0.033 (0.052)	0.133*** (0.047)	0.134** (0.059)
Restricted work	—	−0.469 (0.898)	−0.080 (0.981)	1.136 (1.067)	—	−0.229 (0.806)

a. Bootstrapped standard errors in Columns 2, 3, 4, and 6. Other regressors in the duration model include controls for age, sex, race, tenure at current establishment, firm size, occupation, detailed industry, event of injury, and missing race.

including the indirect effect via restricted work. We expect that the indirect effects will counteract the direct effects.

The model in Columns 1 and 5 is most similar to the standard specification found in the workers' compensation literature. Higher weekly benefits had statistically insignificant effects on work loss for all categories (Column 1) and within the sample of compensable cases (Column 5). They were positively and significantly related to days away from work only for compensable back sprains. The waiting periods had no effect on days away from work for sprains and strains but they significantly increased work loss for carpal tunnel and fracture cases.

Restricted work appeared to substitute for days away from work for all categories in Column 2 with statistically significant effects for back sprains and carpal tunnel cases. The evidence was mixed for compensable cases where the substitution was significant only for carpal tunnel cases. Restricted work appeared to cause a generally insignificant reduction in days away from work for small firm workers. The evidence was again mixed for workers in firms with more than 250 workers. However, as implied by our model, restricted work had the greatest effect on days away from work for those injuries like sprains and carpal tunnel syndrome that were more susceptible to moral hazard problems.

In Column 2, weekly disability benefits had a statistically significant and positive effect on days away from work for the full sample of back sprains and carpal tunnel cases. The results by firm-size category showed that these positive effects were stronger for smaller firms with fewer than 250 workers than for larger firms. A comparison of Columns 1 and 2 supports our hypothesis that the provision of restricted workdays mitigates the positive effect of compensation benefits on the duration of work loss for these injuries. When restricted workdays are not included, the coefficient on weekly benefits in Column 1 represents the combination of its direct effect on workers and its indirect effect via employers' provision of restricted workdays. Since higher benefits increase the provision of restricted work, and this in turn substitutes for days away from work, the effect in Column 1 is a downward biased estimate of the direct effect of higher compensation benefits on the duration of work loss.

Controlling for changes in weekly benefits in Column 2, longer waiting periods appeared to have no direct effect on work-loss durations for all four injury types. Recall that waiting periods were negatively related to the provision of restricted workdays. Finally, including the state unionization rate helps to indirectly check the hypothesis in Leigh (1985) that the positive relationship between income replacement rates and the duration of work loss arises because states with risky industries and severe injuries respond to workers' concerns by increasing the compensation available to them upon injury. If such states are also more likely to be unionized giving workers more influence on state benefit policies, then controlling for union membership rates by state should help to mitigate some of this reverse causation.[20] Our results show that the positive effects of weekly benefits for back sprain and carpal tunnel cases persist even after controlling for the state unionization rate, and the union membership rate itself insignificantly reduces the duration of work loss for these cases.

20. Such a strategy also is suggested in Footnote 6 of Leigh (1985). State union membership rates were calculated using the 1993 monthly CPS files.

Table 7
Income Replacement Effects on Restricted Workdays and Duration of Work Loss

Kind	Back Sprains	Other Sprains	Fractures[a]	Carpal Tunnel
Effect of increase in weekly benefits on probability of restricted work[b]				
$1 increase—all	0.0007	0.0002	−0.00005	0.0003
$1 increase—compensable case	0.0008	0.0001	0.00009	0.0005
Percent change in work loss as the direct effect of a 10 percent increase in the weekly benefit[c]				
$25 increase—Column 2	4.0	0.075	0.18	4.00
$25 increase—Column 6	3.0	−1.400	−0.50	2.25
Percent change in work loss as the indirect effect of a 10 percent increase in the weekly benefit				
$25 increase—Column 2	−3.00	−0.35	0.15	−1.20
$25 increase—Column 6	0.06	−0.05	−0.10	−2.20
Benefit elasticity of work loss—Column 2	0.10	−0.03	0.03	0.28
Benefit elasticity of work loss—Column 6	0.30	−0.14	−0.06	0.003

a. Excludes head and neck fractures.
b. Evaluated at means of the independent variables using univariate probit coefficients in Tables 2–5.
c. Based on coefficients from Columns 2 and 6 of Table 6.

Table 7 reports the magnitude of weekly benefit effects on the use of restricted work as well as on days away from work.[21] The bottom two panels of Table 7 show the direct and indirect effects of an increase in the weekly temporary disability benefit of $25 (approximately 10 percent) on the number of days away from work for the four injury categories. From Table 6, we see that a 10 percent increase in the weekly benefit directly led to a 4 percent increase (0.0016 times 25) in days away from work for back sprains. From the top panel of Table 7, we see that a one dollar increase in the weekly benefit resulted in a 0.0007 increase in the probability of restricted work, leading to an indirect reduction in duration of work loss of approximately 0.12 percent (0.0007 times −1.74). Thus, a 10 percent increase in the weekly benefit indirectly reduced the number of days away from work by 3 percent (−0.12 percent times 25) leading to a small net positive impact on the duration of work loss. Analogous calculations for the smaller sample of compensable cases are also reported in Table 7. The direct effect of weekly benefits was similar for the two samples of back sprains but since the substitution between restricted work and days away from work was smaller for compensable cases the indirect effect was less negative. The benefit elasticity of days away from work was thus 0.1 for the whole sample and 0.3 for compensable cases. By comparison, Butler and Worrall (1985) reported an elasticity of 0.18 for a random sample of National Council on Compensation Insurance claims for lower back injuries. Similar calculations are performed for the other injuries.

VI. Summary and Conclusion

Our results show that higher weekly benefits and shorter state waiting periods increased the use of restricted workdays in 1993, which in turn reduced days away from work for back sprains and carpal tunnel cases. Controlling for restricted work, higher benefits had a statistically significant, positive effect on days away from work for back sprains and carpal tunnel cases. These results suggest that firms may use restricted work to lower workers' compensation costs. Restricted work is most effective in countering the positive effects of benefits on days away from work for hard-to-diagnose injuries like back sprains and carpal tunnel cases, with potential for moral hazard.

By not accounting for whether the injured workers were accommodated through restricted workdays, our results suggest that the incentive effects reported in the literature are downward biased estimates of the direct effect of workers' compensation benefits on the duration of work loss. For carpal tunnel injuries, this downward bias reduced the estimated effect of benefits by more than half. Given the growing use of restricted work provisions for injured workers, they should be included in future research on the duration of work loss.

The results for small and large firms run counter to what we expected given experience rating for large firms and may indicate the presence of other size-specific influences that we have not controlled for. Data on the educational attainment and marital

21. These magnitudes are based on Columns 2 and 6 of Table 6 where workers' compensation variables as well as restricted work are included in the model.

status of the worker would strengthen our results.[22] Finally, to the extent that we have not controlled for all state level factors that affect both income replacement rates and days away from work, we cannot be sure that the effects shown in this study are causal in nature. However, our analysis with state union rates strengthens the evidence in this direction.

The results presented in this paper are interesting given the increased focus on return to work as a principal goal of state worker's compensation systems. Many states reformed their systems in the 1990s following the rapid rise of workers' compensation costs during the 1980s. The reforms emphasize workplace safety and health programs, medical cost containment, and return-to-work programs aimed at reducing the time that workers receive income replacement benefits. Several states have enacted legislation aimed at both employees (for refusing work assignments appropriate to their injuries) and employers (for failing to take workers back).

Our cross-sectional results show that employers are more inclined to offer restricted work in states with higher income replacement benefits. However, this positive relationship does not show up over time. The 1990s actually saw both an increase in restricted work use and a decline in workers' compensation benefits (both cash and medical care benefits, a reversal of the trends observed in the 1980s) (Mont, Burton, and Reno 1999). These data suggest that there may be other trends in the workplace like a greater emphasis on workplace flexibility, that increase use of restricted work arrangements particularly for those workers with higher benefits.

The administration of workers' compensation medical benefits has also changed with greater controls of managed care over medical costs. Managed care organizations (MCOs) may, in addition to their standard services, have extensive return-to-work programs. For example, in Oregon, MCOs conduct on-site job visits and use disability prevention consultants and worker recovery plans to identify work restrictions and job modifications. Firms covered by managed care contracts were also more likely to participate in the Oregon Employer-at-Injury Program that offers financial incentives like wage subsidies, worksite modifications, and equipment purchases to employers who return injured workers to restricted duties. Such return-to-work programs are seen as very effective cost-containment strategies. In Oregon, the average length of the first spell of days away from work decreased 18 percent from 1990 to 1997.

In addition to workers' compensation reforms, it is possible that increased use of restricted work is an unintended consequence of the Americans with Disabilities Act, 1990 that requires employers to provide reasonable accommodations to disabled workers. While the ADA and workers' compensation define disability differently, the ADA may have already compelled employers to invest in the administrative apparatus and worksite modifications needed to accommodate people with disabilities, making it easier to offer restricted work to employees with occupational injuries. The interactions between the implementation of the ADA and the use of restricted work would be an interesting subject for future research.

22. Employers may be more likely to accommodate educated workers with more firm-specific human capital. Also, more educated workers may be in higher-paying, less-risky jobs and, therefore, will be less likely to experience serious, disabling on-the-job injuries. Thus, our estimates of the substitution between restricted work and days away from work may be upward-biased.

In spite of these caveats, this paper highlights the importance of restricted workdays as a tool in case management for workers' compensation agencies and for employers. Previous work has shown that employer accommodations increase the odds of successful return to work with fewer relapses. Our results show that employers may also use restricted work to mitigate any adverse incentive effects of workers' compensation on the duration of work loss.

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