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Workers' Compensation, Wages, and the Risk of Injury

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Abstract

[Excerpt] In many respects the structures of the workers' compensation and unemployment insurance systems are similar. Each is actually a system of individual state systems. Both are financed by a payroll tax that is imperfectly experience rated. Both provide insurance against an adverse consequence (work injury or unemployment) that leads to time away from work; the incidence and duration of these events are at least partially determined by both employer *and* employee behavior. Both systems provide, at least for temporary events, a structure of benefits that ties compensation to a worker's previous earnings.

Because of these similarities, it is not inappropriate for an individual such as myself, who has conducted some research on the unemployment insurance system but none on the workers' compensation system, to provide an analysis and summary of the effects of the latter on work injury experience. Indeed, one contribution of this chapter will be to point out how lessons learned from research on other forms of social insurance can be applied to research on workers' compensation. Nonetheless, there are important differences in, and complexities of, the workers' compensation system that analyses of it must take into account; these are highlighted as well.

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4·WORKERS' COMPENSATION, WAGES, AND THE RISK OF INJURY

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In many respects the structures of the workers' compensation and unemployment insurance systems are similar. Each is actually a system of individual state systems. Both are financed by a payroll tax that is imperfectly experience rated. Both provide insurance against an adverse consequence (work injury or unemployment) that leads to time away from work; the incidence and duration of these events are at least partially determined by both employer *and* employee behavior. Both systems provide, at least for temporary events, a structure of benefits that ties compensation to a worker's previous earnings.

Because of these similarities, it is not inappropriate for an individual such as myself, who has conducted some research on the unemployment insurance system but none on the workers' compensation system, to provide an analysis and summary of the effects of the latter on work injury experience. Indeed, one contribution of this chapter will be to point out how lessons learned from research on other forms of social insurance can be applied to research on workers' compensation. Nonetheless, there are important differences in, and complexities of, the workers' compensation system that analyses of it must take into account; these are highlighted as well.

I begin with a brief overview of the characteristics of the workers' compensation system. I then sketch some simple labor market models that suggest how the system might affect employee compen-

sation and the frequency and duration of work-related injuries. Critical analysis of the empirical literature on these effects follows.

Characteristics of the Workers' Compensation System

As mentioned above, the workers' compensation system is actually a composite of state systems; variations in the values of key parameters across states provide the basis of many of the empirical analyses discussed later.[1] Workers' compensation benefits are a form of no-fault insurance in which employers agree to pay specified benefits to workers injured on the job in return for limited liability. The no-fault aspect of it, however, still leaves employers the right to challenge claims on such grounds as that the injury did not take place on the job, the injury is not as severe as the employee claims, or an injured employee is not returning to work as quickly as is possible. The frequency with which claims are challenged may well vary across states (Burton and Berkowitz 1982, 80).

Five types of benefits are paid under the workers' compensation system. First, *medical benefits* are provided to injured workers. Second, *temporary total disability* benefits are paid to injured workers who temporarily cannot work at all but for whom full recovery is expected. There typically is a waiting period, which varies across states, before benefits commence, and the benefits are specified as a fraction of preinjury earnings. This fraction, the income-replacement rate, usually is set at two-thirds; however, each state specifies a minimum and maximum benefit level (the latter is often tied to average weekly earnings in the state).

Third, *permanent total disability* benefits are paid when an individual is permanently prevented from working at all. The structure of benefits is similar to temporary total disability benefits; in some cases there is also a maximum duration of time in which benefits may be received.

Fourth, *permanent partial disability* benefits are paid for injuries that are expected, even after the healing period, to result in permanent physical impairments and/or limitations on earnings capacity

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1. Much more detailed discussions of the workers' compensation system are presented elsewhere. For example, see Burton 1983, Burton and Berkowitz 1982, Victor 1983, Victor, Cohen, and Phelps 1982, and Worrall 1983. My discussion, which is unabashedly pirated from them, is necessarily brief and nontechnical.

and/or reductions in actual earnings. In many states, these benefits are determined ex ante (before the permanent consequences of the injury are experienced) and are not conditional on ex post loss of earnings, while in a few states, benefits for certain types of injuries (nonscheduled ones) depend on actual earnings loss. In these latter states, benefits for other types of injuries (scheduled ones) do not depend on actual earnings loss. In most states, however, nonscheduled benefits do not depend on actual earnings loss. Finally, *burial and survival benefits* are paid on death claims, which are a small share of claims. Permanent partial disability and temporary total disability are, in order, the two most important categories of indemnity claims, based on dollar expenditures (together representing more than 80 percent of workers' compensation indemnity costs), while temporary total disability claims are by far the most frequent type of claims.

Most firms purchase insurance against workers' compensation claims either from a government or private insurance carrier, depending on the state (some states offer both options). Premiums are paid by employers as a percentage of total payroll. Small employers are manually rated, or charged a premium based on historical experience of the industry class to which they belong. As a result, their workers' compensation payroll tax is imperfectly experience rated in that, at the margin, they do not bear the full cost of workers' compensation benefits paid to their employees.

As an employer becomes larger, the manual rate is modified more and more to reflect the injury experience of the firm. Indeed, the rates of very large firms depend solely on their own historical experience; they are said to be perfectly experience rated (in principle, they bear the full costs of workers' compensation benefits received by their employees). Large firms also have the option of self-insuring, which also leads to perfect experience rating. In general, over a wide range of firm sizes, workers' compensation costs are imperfectly experience rated, with the extent of experience rating increasing with firm size.[2]

Two final points warrant mention here. First, workers' com-

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2. A more detailed discussion of experience rating is found in Victor 1983. John Burton has stressed to me that even very large firms are likely to insure themselves against catastrophes and thus not to have a 100 percent perfect experience rating.

pensation benefits are not taxable; thus their net worth depends on a worker's family income bracket. Second, recipients of workers' compensation benefits may receive other forms of insurance benefits that are conditioned on either their disability status (e.g., Social Security or private disability payments) or their family income level (e.g., food stamps). Empirical analyses of the incentive effects of workers' compensation benefits should (but typically do not) take into account both the tax treatment of workers' compensation benefits and the existence of these other forms of benefits. Both omissions may distort estimates of the incentive effects of workers' compensation.

Workers' Compensation Effects: Theory

Consider a simplified world in which the labor market is competitive, workers have perfect information about the risks of injury associated with each job, and there are no barriers to mobility between jobs.[3] Suppose also that firms differ in their production technology; that each technology has certain inherent risks of injury associated with it, which can be reduced if firms expend resources to do so; and that the marginal cost (to the employer) of reducing risks varies across firms.

Assume also, initially, that workers value positively their expected earnings per period (earnings times the probability of not being injured) and value negatively the probability of being injured. Workers will move to firms whose wage rates–risk of injury combination maximizes their well-being and, if all workers have identical preferences, firms with higher risks of injury would have to pay higher wages to attract workers. The mobility of workers would thus lead to *fully compensating* wage differentials, or wage differentials that compensate workers for the disutility they would suffer from risk of injury.[4]

In such a world, firms would offer the wage rates–risk of injury combination so that their marginal cost for injury reduction would

3. The discussion here draws heavily on previous discussions. See the sources cited in note 1 as well as Chelius 1974, 1977, and 1983. I have again abstracted from many details of the program and ignored a host of issues.

4. If workers have different degrees of aversion to risk, they will sort themselves across firms so that those with the least aversion will be in the high-risk firms. The market wage differential between low- and high-risk firms will understate the wage differential that workers at low-risk firms would demand to move to high-risk firms.

equal their marginal benefits from injury reduction. The former includes the costs of resources devoted to preventing accidents, while the latter includes the lower bill for wages associated with the lower accident rate, less downtime in production, and reduced hiring and training costs of replacements for injured workers. If the marginal cost of preventing accidents varied across firms, different firms would offer different "wage-injury rate packages."

In such a world, the introduction of workers' compensation benefits that were perfectly experience rated (and contained no loading or administrative charges) would not affect the injury rate at any firm. Rather, because workers' compensation benefits would now compensate workers if they were injured, smaller compensating wage differentials would be required to attract workers to firms with high injury rates. Thus higher workers' compensation benefits should lead to lower wages at each firm. Workers' compensation benefits would not affect the injury rate that was optimal from each firm's perspective, since the firm's reduction in wage costs would just be offset by the new workers' compensation costs.

Suppose, instead, that workers' compensation benefits were not perfectly experience rated. In this case, the reduction in wage costs resulting from the payment of benefits would be greater than the employers' liability for the benefits. The marginal benefits of preventing accidents would therefore fall, and employers would spend fewer resources on injury reduction. In this case, imperfect experience rating would lead to a *higher* injury rate than would exist either in the absence of the workers' compensation system or in the presence of a workers' compensation system that was perfectly experience rated.

Of course all of the above presupposes a perfectly competitive labor market in which wage differentials arise to compensate workers fully for risk of injury. In such a world, if workers are risk neutral, there is in fact little rationale for a workers' compensation system.[5] If, however, fully compensating wage differentials do not arise, the

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5. If workers were risk averse, they would prefer the certainty of workers' compensation benefits when an injury occurs to a risk premium with the same expected value. In this case, the introduction of workers' compensation benefits would improve workers' welfare. One should caution, however, that in this situation, the resulting decline in the risk premium would exceed the actuarial value of the workers' compensation benefits, which would decrease employers' incentives to prevent risks. Thus, again, the injury rate might rise relative to the injury rate that would prevail in the absence of the system.

predicted effects of workers' compensation benefits are quite different.

Consider again the case of a perfectly experience-rated workers' compensation system in which employers bear the full costs of the workers' compensation benefits paid to their employees. In this situation, in which wage differentials do not initially fully compensate workers for risk of injury, the marginal costs of injuries for employers would rise in the presence of workers' compensation benefits (wages would not fall sufficiently to offset the cost of benefits). As such, employers would have increased incentives to take actions to reduce injury rates, and one would expect to observe a decline in the injury rate.[6]

From the employers' side of the labor market, then, the effect of the workers' compensation system or higher workers' compensation benefits on resources employers devote to reducing work injuries, and hence the injury rate, is ambiguous. If wage differentials do fully compensate workers for the risk of injury and the system is imperfectly experience rated, the injury rate may actually increase. If wage differentials are not fully compensating and the system is perfectly experience rated, the injury rate will decrease. Empirical analyses are required to resolve the ambiguity.

One should distinguish, however, between incentives for employers to increase resources devoted to injury prevention, and thus decrease the injury rate, and incentives for employers to reduce both the incidence and duration of workers' compensation claims. As long as workers' compensation benefits are at least partially experience rated, higher benefits will increase employers' incentives both to challenge claims and to encourage injured workers to speed their recovery and return to work. Even if increasing benefits does not alter employer resources devoted to injury prevention, it may affect the number and duration of claims.

The above discussion focuses on the employer side of the labor market. Increasing temporary total workers' compensation benefits may also affect injury rates and claims by influencing employee behavior. First, higher benefits may reduce the disutility workers feel

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6. In a world where all workers' compensation costs are not shifted to workers, in the form of lower wages, or to consumers, in the form of higher prices, there also would be employment effects. See Ehrenberg, Hutchens, and Smith 1978 for a discussion of the evidence on the shifting of the payroll tax.

when they have *minor* and *temporary* illnesses. Thus higher benefits may reduce the precautions they take on the job to prevent accidents that are unlikely to lead to serious permanent injuries. Second, higher benefit levels increase employees' incentives to file claims for minor injuries in which the need to remain temporarily off the job is ambiguous.[7] Third, to the extent that workers at least partially control the speed at which rehabilitation from temporary disability occurs, higher benefits increase workers' incentives to prolong their recovery period.

From workers' perspectives, then, higher temporary total disability benefit levels may lead to increased workers' compensation claims. Whether this is due to an increase in injury rates because workers use less precaution or to an increase in the probability of filing a claim, given a minor injury, is important to determine. Higher benefits may also lead to longer durations for individual claims; however, this does not imply that the average duration of claims would lengthen. If the higher benefits induce a lot of claims based on less severe injuries, the average duration of claims might actually fall.

Permanent partial disability benefits may also affect workers' compensation claim rates and the supply of labor by disabled workers to the market. One must distinguish here between scheduled and nonscheduled benefits that are not contingent on actual earnings loss and nonscheduled benefits that are. In the former case, benefits typically are not contingent on work effort after the benefit determination date; they are specified as a lump-sum or weekly amount for a fixed duration. These benefits increase the injured individual's wealth (assuming medical expenses have also been fully compensated). To the extent that individuals value leisure time as well as income, higher scheduled benefits should lead to fewer hours of work and a reduced fraction of time in the labor force.

In some states, however, such as New York and Florida, nonscheduled benefits are specified as a fraction of earnings losses (preinjury earnings minus postinjury actual earnings), subject to maximum benefit levels. Benefits here are contingent on work effort and, like any income-transfer system of this type (e.g., Aid to Families with

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7. For both of these reasons, a decline in the length of the waiting period before benefits can be received would also increase the number of workers' compensation claims.

Dependent Children), higher wage-replacement rates encourage reduced labor force participation and hours of work. Furthermore, the formulas used to compute benefits under such systems do not take into account that economic conditions may affect the earnings prospects of injured workers; benefit levels do *not* depend on local unemployment rates. Because higher unemployment rates reduce the actual earnings prospects of some injured workers relative to their nonscheduled permanent partial benefits, one would expect permanent partial claim rates for nonscheduled benefits in these states to increase when unemployment rates are high.

In sum, workers' compensation benefit levels, operating through both the employer and the employee side of the market, should be expected to influence the magnitude of compensating wage differentials, efforts by employers to reduce injury rates, injury rates per se, the number and types of workers' compensation claims, the durations of different types of claims, and the labor force attachment and hours of work of injured workers. It is to an analysis of the empirical evidence on many of these effects that I now turn.

Compensating Wage Differentials

The first issue is whether markets "work" in the sense that wage differentials arise to compensate workers for exposure to risk of injury. Numerous studies have used cross-section data, with either establishments or individuals as the units of observation, and attempted to ascertain if wage rates are positively associated with various measures of injury risk (fatal accident rates, nonfatal accident rates, workdays lost as a result of accident rates, and so on), after other personal characteristics that should influence wages (e.g., education, experience) are controlled for.[8]

These studies uniformly tend to find that there is a positive association between fatal accident rates and wages. The relationship between nonfatal accident rates and wages is less well established, however; it appears in some studies but not in others. Most studies

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8. The pre-1979 studies are summarized in Smith 1979. Examples of later studies include Brown 1980, Burton 1983, Butler and Worrall 1983, Dickens 1984, Freeman and Medoff 1981, Olson 1981, Ruser 1986, Smith and Dillingham 1984, Viscusi 1978, 1979, and 1980, and Viscusi and Moore 1987. Recent attempts that use longitudinal data include Duncan and Holmlund 1983 and Moore and Viscusi 1987.

indicate that the magnitude of compensating wage differentials is larger in the union sector than in the nonunion sector,[9] an expected result given that accident rates tend to be higher in the union sector and that unions may serve the role of winning wage differentials at the bargaining table to compensate their members for unfavorable job characteristics when "the market" fails to produce such differentials (see Worrall and Butler 1983 and Duncan and Stafford 1980). The result, that compensating wage differentials are larger in the union sector, is not unique to risk of injury. Others have found similar results for such unfavorable job characteristics as mandatory overtime requirements (Ehrenberg and Schumann 1984).

Somewhat surprisingly, many studies fail to consider the possibility that interstate, intertemporal, or interindustry variations in the generosity of workers' compensation systems, as measured by income-replacement rates, might affect the magnitude of the differentials in compensating wages. The few studies that have *do* find that higher workers' compensation income-replacement rates reduce the magnitude of the wage differential paid for a given risk of injury.[10] One study has also found that higher risks of injury are associated with higher levels of fringe benefits and with higher wages (Dorsey 1983).

Unfortunately, this voluminous literature provides very little that is of use for public policy. Presumably one wants to know if (1) the market is providing appropriate incentives for employers to take actions to reduce injury rates and (2) the market is *fully* compensating workers for risk of injury. As discussed below, no answer to either of these questions is provided by these studies.

With respect to the first question, the issue is really whether the positive association between wages and risk-of-injury measures reflects a compensating wage differential for risk of injury. Jobs may offer a variety of undesirable working conditions in addition to risk

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9. See Dickens 1984, Freeman and Medoff 1981, Olson 1981, and Viscusi 1979, for example. Smith and Dillingham (1984) find this result in 1973 data but not in 1977 or 1979 data. Ruser (1986) finds the result only for females.

10. See Arnould and Nichols 1983, Butler 1983, Dorsey 1983, Dorsey and Walzer 1983, Ruser 1986, and Viscusi and Moore 1987. While all these studies agree that higher workers' compensation benefits are associated with lower wages, holding injury rates constant, they differ on how the level of workers' compensation benefits affects the *marginal* effect of injury rates on wages. For example, Ruser (1986) finds that higher benefits do not alter the wage-injury rate trade off, while Viscusi and Moore (1987) find higher benefits *increase* the marginal compensating differential for injury risk.

of injury; these may include having to work in a noisy environment, having to do repetitive tasks, being required to do heavy lifting, and lacking the opportunity to make independent judgments. Many of these job characteristics are probably highly correlated with risk of injury on the job, and workers may demand wage premiums to accept them. As a result, when one omits these other job characteristics from the analysis, any effect they have on wages is captured by the risk-of-injury variable. Thus one may well overstate the true magnitude of the compensating wage differentials for risk of injury.[11] When a few investigators have included other working conditions along with risk of injury in wage equations, the risk-of-injury variables tended not to be significantly associated with wages (see, for example, Brown 1980). Whether this is due to the high collinearity of the working conditions variables (which makes estimates imprecise) or to the nonexistence of a true wage–risk of injury differential cannot be determined. In either case, the evidence on the existence of compensating wage differentials *for* risk of injury is not as well established as the various studies would have us believe.

Suppose we ignore this problem and assume that wage differentials for risk of injury do exist. How could one hope to decide that their magnitudes are sufficiently large to permit one to conclude that they *fully* compensate workers for the disutility associated with risk of injury? Only if they are, as is implicitly assumed in a discussion of the subject in chapter 6 of the *1987 Economic Report of the President*, is the case for government intervention to improve occupational safety weakened. Only if they are can one derive "value-of-life" estimates from them to use in benefit/cost studies of occupational safety and health interventions. (See Ehrenberg and Smith 1988, 272–76, for examples of such benefit/cost analyses.)

Now, if one truly believes that all labor markets are competitive, it is a tautology that whatever wage differentials are generated by these markets will be "fully compensating" ones. Once one allows for market imperfections, however, the question becomes an empirical one. The mere existence of *some* wage differential does *not* imply that it is a fully compensating one.

Estimates of the compensating wage differentials associated

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11. This criticism is really directed at the whole "compensating wage differential" literature and is not unique to studies of risk of injury.

with the risk of fatal injury at the workplace suggest that individuals are paid a premium of 1 to 4 percent of their wages to compensate them for existing risks of fatal injury; this leads (given the magnitude of fatal injury rates) to imputed values of lives in the range of $200,000 to $3,500,000 (see Smith 1979). Researchers have no way of evaluating (nor have they even tended to consider) whether differentials in this range truly fully compensate workers for risk of fatal injury.

As a result, the potential usefulness for public policy in occupational safety of estimates of compensating wage differentials for injury risk is limited. On the one hand, if these estimates truly reflect differentials paid for risk of injury, they may provide only lower-bound estimates of the value of life. On the other hand, if they also reflect a premium paid for other unmeasured unfavorable job characteristics that are correlated with job risk, they may lead one to overstate the true value of life.

Workers' Compensation Benefit Levels and Work Injury Experiences: State Data

In theory, the incidence and duration of work injuries depends on both employee and employer actions. Given the discussion above, this suggests that both the level of benefits *and* the extent of experience rating should affect injury rates. Yet only two empirical studies, to be discussed below, have attempted to evaluate the effects of experience rating. The studies that use statewide data, or industry-by-state data, tend to ignore experience rating and stress the effects of benefit levels alone on the incidence and duration of injuries and/or claims.

The nine studies summarized in table 4.1 fall neatly into three groups. First, there are three studies by James Chelius (1973, 1974, and 1977) that use a single year's data and find that, controlling for other factors, higher workers' compensation benefits are associated with a higher frequency of injury but have no association with duration (severity) of injury. Second, there are two studies by Chelius (1982 and 1983) and one by John Ruser (1985) that use data for a number of years. Chelius (1982) uses data from thirty-six states for the 1972–75 period and finds that higher workers' compensation benefits are associated with more frequent accidents but fewer days per case, so that on balance they have no association with the total rate

TABLE 4.1. Studies of the Relationship between Workers' Compensation Benefit Levels and Injury Rate or Indemnity Claim Frequency and Duration that Use State Data as the Unit of Observation

Study	Data Period and Coverage	Workers' Compensation Benefit Variable	Outcome Variables	Effect of Higher Benefit Levels	Other Workers' Compensation Variables Included (Effect of Increase)
Chelius (1973) Chelius (1974) Chelius (1977)	1967 state-by-manufacturing industry data	Workers' compensation benefit level in the state and industry (actuarial estimates or implied, given average wages, from laws)—weighted average of different types of cases	BLS* Frequency of injury Severity of injury	Increase No effect	—
Chelius (1982)	1972–75 data by manufacturing industries for 36 states	Workers' compensation benefit level in state-industry cell for total temporary injuries divided by average earnings in cell (benefits implied by law given average earnings)	OSHA Frequency rate Days per case Lost workday rate	Increase Decrease No effect	Waiting period (decrease) (no effect) (decrease)
Chelius (1983)	1972–78 data by manufacturing industries for 28 states	(same as above)	OSHA Frequency rate Days per case Lost workday rate	Increase No effect Increase	Waiting period (no effect) (no effect) (no effect)

TABLE 4.1 (*continued*)

Study	Data Period and Coverage	Workers' Compensation Benefit Variable	Outcome Variables	Effect of Higher Benefit Levels	Other Workers' Compensation Variables Included (Effect of Increase)
Ruser (1985)	1972–79 3-digit manufacturing data for 41 states	Average weekly workers' compensation benefit in the state-industry cell for temporary total disability	OSHA Frequency rate of cases Frequency of lost workdays	Increase Increase	Waiting period
Butler and Worrall (1983)	1972–78 data for 35 states	Average weekly workers' compensation benefit in the state for (a) temporary total (b) minor permanent partial (c) major permanent partial injuries (computed from state laws, average wage and assumed wage distributions)	NCCI claim rates for nonself-insuring firms for (A) temporary total (B) minor permanent partial (C) major permanent partial injuries	A B C a 0 + + b 0 + 0 c 0 − +	Waiting period (A—decrease) (B—decrease) (C—no effect)
Butler (1983)	15 industries in South Carolina for a 32-year period	Index of average *real* annual workers' compensation payments for various types of injuries	South Carolina Industrial Commission statistics on Lost workday rate Death rate Permanent total rate Permanent partial rate Temporary total injury rate	 Increase Increase Increase Increase No effect	

TABLE 4.1 (*continued*)

Study	Data Period and Coverage	Workers' Compensation Benefit Variable	Outcome Variables	Effect of Higher Benefit Levels	Other Workers' Compensation Variables Included (Effect of Increase)
Worrall and Appel (1982)	1958–77 data for the state of Texas	Income-replacement rate for temporary total injuries in the state	NCCI data Temporary total claims/medical-only claims	Increase	—
			All indemnity claims/medical-only claims	Increase	

SOURCE: Author's interpretation of material in the original articles. In the Butler and Worrall (1983) row, a " + " indicates increase, a "0" no change, and a "−" a decrease.

*Bureau of Labor Statistics.

of lost workdays. His later study (1983) uses data for only twenty-eight states but a longer period (1972–78) and finds that although the workers' compensation benefit-frequency association is still observed, the benefit–days-per-case relationship vanishes. As a result, higher benefits are associated with an increased total rate of lost workdays. Whether the differences in results between the two studies reflect changes in behavior that occurred in 1976–78 or the dropping of eight states from the sample is not investigated by Chelius.

Finally, Ruser (1985) uses data from forty-one states for the 1972–79 period and finds that higher benefits are associated with higher frequencies of injuries and days lost from work.

Focusing on Chelius (1982), one might ask how higher benefits could simultaneously increase frequency but decrease duration. Unfortunately, there are a number of possible explanations, which the data do not permit us to disentangle. Higher benefits might induce the reporting of minor injuries that otherwise would go unreported and that tend to be of short duration. They might also induce workers to take more risks on the job, but only in situations that would not lead to increased risk of serious long-term injuries. Finally, they might induce employers to concentrate accident prevention resources where long-term injuries are possible, to challenge long-term claims more frequently, or to "encourage" injured workers to return to work more rapidly. Presumably data on workers' compensation claims challenges are available; however, to my knowledge, no researcher has attempted to analyze whether challenges of claims by employers (either at the outset or while a claim is in progress) are related to the level of benefits.

The third group of studies analyzes different types of data. Richard Butler (1983) focused on data from one state, South Carolina, over a long period and found that an index of average *real* annual workers' compensation payments for various injuries in the state was positively associated with the frequency of almost all types of injuries. Butler and John Worrall (1983) used workers' compensation claims data for thirty-five states over the 1972–78 period and computed estimates for each state and year of the levels of various types of benefits. They found benefit levels were associated primarily with permanent partial claims rates, not with temporary total ones. While an increase in the minor (major) permanent partial benefit level was associated with a higher minor (major) permanent partial injury rate,

an increase in the major permanent partial benefit level also reduced the incidence of minor permanent partial claims.[12]

This latter result is intriguing in that it suggests that injured workers have some control over how they get their claims classified, whether as a major or a minor injury. Again, there is the possibility that at least part of the observed effect on injury rates may simply be a reporting effect.[13] Evidence to support this view is presented by Worrall and Appel (1982), who found that higher income-replacement rates for temporary total injuries have been associated over time in Texas with an increase in the ratios of temporary total claims and all indemnity claims to medical-only claims.

Similarly, Chelius (1982, 239) found that frequency rates for injuries that involve no lost days appear not to be sensitive to benefit levels; because the waiting period in most states is at least three days, higher benefits offer workers no added incentive to report injuries in this category. He argues that any positive relationship here would indicate a real association between benefits and this short-term injury rate, and this relationship is not observed. Two studies (Chelius 1982 and Butler and Worrall 1983) also found that longer waiting periods are associated with decreased injury rates or claims; whether this is a reporting or a real effect was not ascertained.

Taken together, these studies strongly suggest that increases in workers' compensation benefits are associated with higher injury and claim rates, with at least some fraction of the increase being a pure "reporting" or "classification" effect. They do not, however, provide any strong evidence on duration of claims or injuries, primarily because increased frequency results in changes in the mixture, or types, of injuries reported. To analyze accurately the effects of benefit levels on the duration of claims requires data on individual claims; two such studies are discussed in the next section.

The later studies described in this section are methodologically more sophisticated, controlling for more variables and using more refined data. Nonetheless, their conclusions should probably be tem-

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12. Major claims are considered more serious than minor ones; the classification depends on the magnitude of the indemnity payment for the injury. This raises the possibility that what is considered a major claim may vary across states.

13. As noted above, Butler and Worrall (1983) find workers' compensation benefits have a larger effect on permanent partial than temporary total claims. The effect on permanent partial claims is unlikely to reflect primarily a reporting effect.

pered for at least two reasons. First, conclusions about the effects of workers' compensation benefits on rates of injuries or injury claims are essentially drawn from observations on the association between benefit levels and injury rates across states or on the association between changes in benefit levels and changes in injury rates over time. Very little concern has been expressed that high injury rates in a state create pressure to have generous benefits or that increases in injury rates create pressure to increase benefit levels. Put another way, there have been only limited efforts (see, for example, Chelius 1974) to test for the possibility that the direction of causation runs from injury rates to benefit levels, rather than vice versa.

Second, the workers' compensation system is a complex system that involves much more than simply specifying the benefit level and waiting period. For example, presumably the extent of experience rating differs across states (and over time) as do administrative stringency in processing claims and the propensity of employers to challenge claims.[14] In contrast to research on unemployment insurance, where these factors have been considered, research on workers' compensation has tended to ignore them.[15] If these variables are correlated with benefit levels, their omission will distort the relationship between the estimated benefit level and the injury rate.

Benefit Levels and the Duration of Claims

Butler and Worrall (1984) and Worrall and Butler (1985) have used data on individual workers' compensation claimants in the state of Illinois to analyze the effects of workers' compensation benefit levels on the duration of temporary total disability claims.[16] The data are confined to one state to control for other aspects of the workers'

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14. The structure of experience rating is the same across most states at any point in time. The actual extent of experience rating in a state, however, will vary across states with the size distribution of firms, their wage rates, and their prior injury experiences. Hence, in principle, one can compute estimates of the extent of experience rating or of the proportion of firms that are (1) not subject to experience rating or (2) perfectly experience rated and use these in the analyses. There are, of course, obvious econometric problems with this approach.

15. Studies of the effects of administrative stringency in the unemployment insurance literature include Solon 1984 and Horowitz 1977. Studies of the effects of experience rating include Brechling 1981 and Topel 1983.

16. Their research builds on related work for Great Britain by Doherty (1979) and Fenn (1981).

compensation system and to one type of indemnity claim, those arising from low-back injuries, to mitigate the problem of varying mixtures of injury types, found in more aggregate data. The data come from a survey by the National Council on Compensation Insurance (NCCI) of sample claimants in twelve states which began in April 1979 and followed the claimants for forty-two months.

To analyze these data requires estimation methods that take account of the fact that some claimants are still receiving benefits at the end of the forty-two-month period. The two papers use appropriate methods, differing only in the specific stochastic assumptions and assumptions about unobservable variables that they make. These methods have previously been applied to problems of unemployment insurance and unemployment duration, so their papers build directly on research on another social insurance program. (See Flinn and Heckman 1982 and Lancaster 1979, for example.)

Both papers yield the same important result, after controlling for other factors: the higher an individual's income-replacement ratio under the workers' compensation program, the less likely he or she is to leave claimant status and hence the longer the expected duration of his or her claim. A 10 percent increase in benefits is predicted to increase the average duration of a claim by .23 weeks (one day), which represents a 2 percent increase in the lengthening of the average claim (Worrall and Butler 1985). Whether this statistically significant result is large enough to be of "policy significance" is left to the reader to evaluate.[17]

These papers represent, by far, the most sophisticated econometric treatments found in workers' compensation research, and the advantages of using data for a single state and type of injury are evident. Nonetheless, they are not without problems.

In particular, at a point in time in a single state, the income-replacement ratio an individual is scheduled to receive is a negative function of his or her previous earnings. To see why this creates problems, consider how the typical workers' compensation schedule operates. As the top panel of figure 4.1 illustrates, there is a minimum

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17. They also find that when a lawyer represents a claimant, the duration of the claim is longer. This returns us to the issue of administrative stringency and legal challenges. Their data permit them to analyze some of the influences that determine whether or not a lawyer is used. Another study that addresses this issue is Borba and Appel 1987.
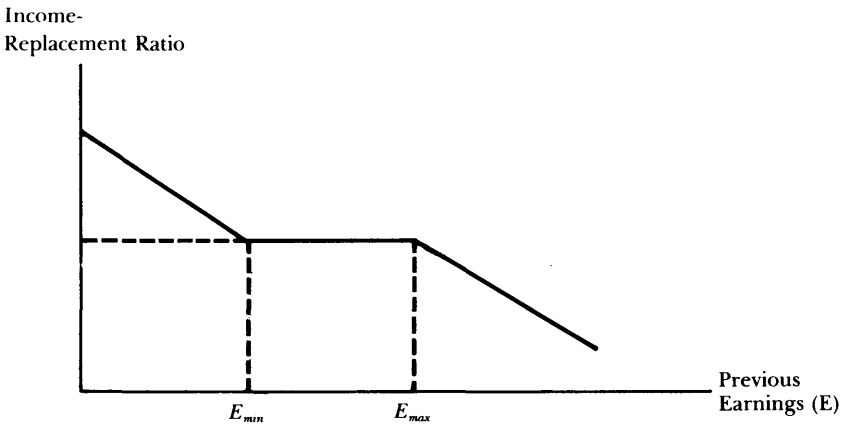
Benefit Levels
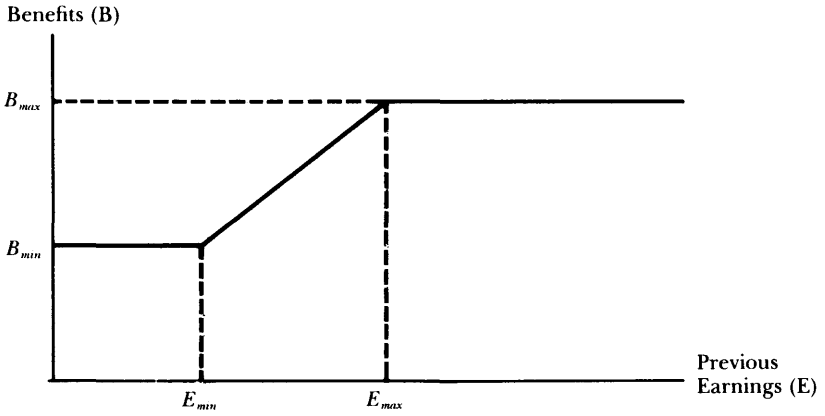
Income-Replacement Ratio

Figure 4.1

benefit level, B_{min}, in the state. If an individual's preinjury earnings fall in the range E_{min} to E_{max}, then benefits increase with earnings. Individuals who previously earned E_{max} or more receive the maximum benefit level in the state, B_{max}. The bottom panel of figure 4.1 shows the implied income-replacement rate (B/E) for this schedule. It is constant (at about two-thirds in most states) between E_{min} and E_{max}; however, outside this region it obviously is negatively related to previous earnings.

If the income-replacement rate for an individual is an exact inverse function of his or her previous earnings, one cannot meaningfully speak of varying the rate at a point in time independently of previous earnings. If both previous earnings and the income-replacement rate appear to influence duration of workers' compensation claims, this may reflect only that previous earnings affect duration in a nonlinear fashion. Without independent variation in the income-replacement rate, we cannot ascertain whether we are really estimating the effect of workers' compensation benefit levels on duration.

Some independent variation may have in fact existed in Butler and Worrall's data.[18] For example, some individuals received lump-sum benefit awards rather than weekly benefits. In these cases, Butler and Worrall divided these amounts by the individuals' *actual* number of claim weeks to obtain a measure of their weekly benefits. This approach causes individuals with claims of randomly long duration to have randomly low reported income-replacement rates. Hence Butler and Worrall tended to *understate* the true effect of workers' compensation benefits on duration. A further problem is that one would expect lump-sum awards to have a different effect on durations of claims than a contingent weekly award. Their approach does not permit this to occur.

The conclusion one reaches here is that although using data from one state has its advantages, it also creates problems. One senses that data from more than one state are needed, although this would require researchers to take other characteristics of the state and state workers' compensation systems into account. Studies of the effect of unemployment insurance benefits on duration of unemployment have used individual data from more than one state, exploiting the interstate variation in replacement rates. (See, for example, Ehrenberg

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18. This paragraph draws on a telephone conversation with Richard Butler.

and Oaxaca 1976.) The twelve-state NCCI sample is a very useful data base for a similar analysis of workers' compensation. In a recent study, Worrall et al. (1985) used these data and found results that were very similar to the single-state (Illinois) studies.[19]

Experience Rating

In spite of the important role that experience rating plays in determining employers' responses (in theory) to an increase in workers' compensation benefits, there have been only two published attempts to analyze empirically whether experience rating affects injury rates. Chelius and Smith (1983) exploit the fact that small, manually rated firms are not experience rated, while very large firms are perfectly experience rated. The difference between injury rates in small and large firms within a single industry obviously will reflect many factors besides the difference in experience rating. If all else is equal, however, the higher the workers' compensation benefits in a state, the greater, they argue, the incentive faced by large firms in that state to reduce their injury rates, and thus the smaller the difference should be. They test whether experience rating matters by seeing if, across states, higher benefits are associated with lower values of the difference in injury rates between small and large firms in each of fifteen two-digit manufacturing industries. They conclude that their data do not permit them to ascertain any effects of experience rating; if present, the effects are too small to be picked up with the crude data they use.

In contrast, Ruser (1985) appears to find that experience rating matters. He uses the same line of reasoning as Chelius and Smith, but tests the "firm size" hypothesis by using pooled cross-section time-series data for forty-one states from 1972 to 1979 on twenty-five three-digit manufacturing industries. He enters an interaction term between the benefit level and firm size in his injury rate regressions and finds a negative coefficient. He attributes his finding that higher benefits appear to reduce injury rates more in states with larger firms (on average) to the greater likelihood that larger firms will face experience rating.

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19. Worrall et al. (1985) also use the Illinois data and find that higher benefit levels increase duration more for older workers than for younger ones.

Taken at face value, the results of Chelius and Smith's study suggest that the reduction in injury rates that increasing the extent of experience rating would bring about is so small that policy makers need not worry that many firms face imperfect or no experience rating. In contrast, Ruser's study suggests that increasing experience rating would significantly reduce injury rates. For a number of reasons, one must be cautious, however, in drawing conclusions from either study. The first reason applies to both studies; the latter ones apply only to the Chelius and Smith study.

First, within an industry, benefit levels vary across states, both because of differences in the generosity of state workers' compensation systems and because of interstate differences in average wages. The latter may reflect differences in the mix of skills workers possess. Any observed (or lack of observed) correlation between benefits and injury rate differences between large and small firms across states or between the average size of firms and the correlation of benefit levels and injury rates may reflect the interaction of the skill mix and firm size on injury rates.

Second, average wage differences within a two-digit industry across states may reflect differences in the three- or four-digit industry mix across states, and there is no reason to suppose that the injury rate–firm size relationship is constant across three- or four-digit industries. This makes it difficult (using the Chelius-Smith method) to separate out the effects of workers' compensation benefits from the effects of industry mix.

Finally, average wage differences across states may reflect differences in the wage rate differential between large and small firms within states.[20] If wage rates differ between firms in a state, injury rates may also differ, for reasons completely independent of experience rating.[21]

One senses from all of this that efforts to estimate the effects of experience rating using aggregate state-by-industry data are not likely to prove fruitful, even when the data are stratified by firm size. At first glance, a more promising strategy appears to be to obtain data

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20. Consider the extreme case in which small firms in every state paid the same wage. A higher average wage in a state would reflect the higher wages paid in large firms and hence the greater wage differential between small and large firms.

21. For example, wage differentials between large and small firms may reflect differences in skills; it is well known that injury rates are related to workers' skills.

at the individual firm level, to impute a marginal workers' compensation cost variable per injury for the firm (using algorithms based on knowledge of the characteristics of the firm and the rules of the experience-rating system) and then to test for the effects of this variable on future injury rates at the firm.[22]

Unfortunately, the marginal cost per injury a firm faces, given its size and wages, will depend on its prior injury rate experience. To the extent that injury rates are correlated over time at a firm, this creates serious statistical problems; it may prove impossible to disentangle the effect of experience rating on injury rates from the effect of injury rates on experience rating. While this effort is worth pursuing, it will require longitudinal data and a careful consideration of statistical issues.

Workers' Compensation and Labor Supply

Several studies have addressed the issue of how permanent partial disability benefits affect labor supply, highlighting the distinction between scheduled and nonscheduled benefits.[23] William Johnson (1983) focused on workers injured in New York State in 1970 who were found eligible for scheduled benefits. These scheduled benefits are specified as weekly amounts for given durations; they are not related to actual wage loss during the period received. Johnson found small effects on the labor supply of benefit levels in 1971, but by 1974 benefit levels appeared to affect neither labor force participation nor hours of work. He suggested that switching to nonscheduled benefits, which are contingent on wage loss, would have the obvious potential to decrease the labor supply.

Some support for this view is found in Burton (1983). Burton used time-series data for New York State from 1959 to 1979 and found that increases in the unemployment rate were associated with a larger number of nonscheduled cases but not with any change in the number of scheduled cases. Workers' compensation payments in the former case are contingent on wage loss, and increases in the

22. Victor (1983) has developed such an algorithm.
23. A number of related studies estimate the effect of the Social Security Disability Insurance program on labor force participation rates. See, for example, Haveman and Wolfe 1984a and 1984b, Leonard 1979, and Parsons 1980a, 1980b, and 1984. These studies tend to focus on the labor force participation rates of all older workers, not the rates for a sample of claimants as Johnson does.

unemployment rate make it harder for disabled workers to find jobs that compensate them at the level of their preinjury jobs.

Burton also found, however, that higher benefit levels reduced the number of nonscheduled permanent partial disability cases. While it is possible that this reflects the dominance of efforts by employers to prevent injuries or injury claims over any reduction in actions by employees to promote safety, it must be stressed that this result flies in the face of all of the evidence summarized in table 4.1. Burton's twenty-year time-series analysis does not appear to control for changes in the industry/occupation/age/gender distribution of the labor force, all of which should influence compensation costs and injury rates (see, for example, Dillingham 1983). To the extent that these variables are correlated with changes in benefit levels over time, the observed effect of benefits on nonscheduled claims may actually reflect the effects of these other variables.

Conclusion

A long critical summary of the literature in an area requires no summary; however, several substantive propositions that have relevance for occupational safety and health policies are worth repeating. First, the evidence on compensating wage differentials for risk of injury is nowhere near as solid as producers of the evidence believe. On the one hand, even if we take estimates of differentials at face value and *assume* that all other nonrisk-related conditions of employment have been fully controlled for, the existence of a differential does *not* imply that workers are *fully* compensated for the risk of injury they face. At best, such estimates can be used to provide lower-bound estimates of the "value of life," which in turn can be used in benefit/cost analyses of various occupational safety and health policies. They *cannot* be used to draw conclusions about how well markets are working. On the other hand, if unfavorable nonrisk-related conditions of employment have *not* been controlled for (as is typically the case), and these are positively correlated with injury risk, the estimated wage differentials will overstate the true compensating wage differential for injury risk and thus *may* provide overestimates of the value of life.

Second, higher workers' compensation benefits do appear to increase the frequency-of-injury rates and workers' compensation claims, although we cannot separate out with any precision how much

of the increase is "real" and how much is merely a "reporting" effect. If the system is at least partially experience rated (which it is) and labor markets are not perfectly competitive (which they probably are not), higher workers' compensation benefits should induce employers to try to prevent accidents and/or to challenge more claims. That a positive relationship between frequency and benefits is observed implies that employees' responses to higher benefits dominate, on balance, over employers' responses.

The trick, then, is to alter existing policy to increase employers' incentives to improve safety without altering employees' incentives. One possibility is to hold benefit levels at their current real levels but to increase the extent of experience rating. As discussed above, there is no real evidence that this would work, and, in any case, such a policy would be strongly opposed by unions. Increased experience rating increases employers' incentives to challenge workers' claims for benefits. For this very reason, unions have been vocal opponents of attempts to increase experience rating in the unemployment insurance system.

An alternative is to increase the payroll tax but *not* the level of benefits and to use the excess of revenue over benefits to fund other safety and health programs.[24] To the extent that experience rating does matter, this will provide employers with increased incentives to improve safety. Similar proposals have previously been suggested with regard to overtime pay—increasing the tax on overtime hours but not the overtime premium paid to workers—and have been supported by at least some unions.[25]

Of course, the fact that increasing workers' compensation benefits does appear to increase the frequency-of-injury rates and/or workers' compensation claims does *not* imply in itself that further benefit increases are undesirable (*or* are desirable). Rather, it only tells us that there is a trade off between higher, more adequate benefits and higher injury rates and claims. Where along the trade off lines we ultimately locate will depend on policy makers' judgments about the optimal combination of adequacy and safety.[26] For example, the

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24. Chelius (1982) has previously suggested this.

25. See Ehrenberg and Schumann 1982, chap. 8, for a discussion of these proposals. The United Automobile Workers has been a noted supporter of them.

26. Viscusi and Moore (1987) provide a methodological framework that can be used to help analyze the adequacy of workers' compensation benefits given the wage-

results in Chelius (1983), taken at face value, suggest that raising the income-replacement rate in a state by 10 percent relative to the national average would increase the number of injuries per one hundred full-time workers in a state relative to the national average by 1.6 percent. Whether such an action would, on balance, be desirable is for policy makers to decide.

Finally, it is worth restressing that very little is known about the effects on the frequency and duration of claims of other characteristics of the workers' compensation system, such as administrative stringency, the frequency of employer challenges, and the frequency of the use of attorneys in claims cases. Research on the causes and effects of these other characteristics would clearly help policy makers improve the design of the workers' compensation system.[27]

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injury rate trade off that exists. Their methodology requires, however, that accurate estimates of the trade off be obtained.

27. Some suggestive evidence on how the benefits to litigating workers' compensation claims vary across states is presented in Butler, Kearl, and Worrall 1984. As noted above, evidence on the variables associated with claimants' hiring of attorneys is found in Borba and Appel 1987 and in Worrall and Butler 1985.