WORKERS' COMPENSATION, WAGES, AND THE RISK OF INJURY

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ABSTRACT

This paper provides an analysis and summary of the effects of the Workers' Compensation (WC) system on wages and work injury experience. It stresses how lessons learned from other forms of social insurance can be applied to research on WC.

I begin with a brief overview of the characteristics of the WC system. Next, some simple labor market models are sketched that provide implications about how the system might affect employee compensation and the frequency and duration of both work injuries and reported WC claims. The bulk of the paper critically analyzes the relevant empirical literature, summarizing what we have learned from it and suggesting future research directions.

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I. Introduction

In many respects the structure 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 totally insane for an individual who has conducted some previous research on the unemployment insurance (UI) system, but none on the workers' compensation (WC) system, to provide an analysis and summary of the effects of the latter on work injury experience. Indeed, one contribution of this paper will be to point out how lessons learned from research on other forms of social insurance can be applied to research on WC. Nonetheless there are important differences in, and complexities of, the WC system that analyses of it must take into account; these are highlighted in the paper as well.

I begin in the next section with a brief overview of the characteristics of the WC system. Section III sketches some simple labor market models that provide implications about how the system might affect employee compensation and the frequency and duration of work injuries. Succeeding sections critically analyze the empirical literature on these effects. A final section provides some concluding remarks.

II. Characteristics of the Workers' Compensation System[1]

As mentioned above, the WC system is actually a system of state systems; variations in values of key parameters across states provide the basis of many of the empirical analyses discussed later. WC 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 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.[2]

Five types of benefits are paid under the WC system. First, uncompensated medical expenses are paid to injured workers. Second, temporary total disability (TTD) 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 pre-injury 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 (PTD) benefits are paid when an individual is permanently prevented from working at all. The structure of benefits is similar to TTP benefits; in some cases there is also a maximum duration of time that benefits may be received.

Fourth, permanent partial disability (PPD) benefits are paid for injuries that are expected, even after the healing period, to result in permanent physical injury and limitations and/or limitations on actual earnings capacity. In many states these benefits are determined exante and

are not conditional on expost 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 paid on death claims are a small share of claims. PPD and TTD are, in order, the two most important categories of indemnity claims based on dollar expenditures (together representing over 80% of WC indemnity costs), while TTD claims are by far the most frequent type of claims.

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

As an employer become larger the manual rate is modified more and more to reflect the injury experience of the firm. Indeed, very large firms' rates depend solely on their own historical experience; they are said to be perfectly experience rated (in principle they bear the full costs of WC 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 WC costs are imperfectly experience rated, with the extent of experience rating increasing with firm size.[3]

Two final points warrant mention here. First, WC benefits are not taxable; thus the net worth of them depends upon a workers' family income bracket. Second, recipients of WC benefits may receive other forms of insurance benefits that are conditioned either on their disability status (e.g., social security or private disability payments) or their family income level (e.g., food stamps). Analyses of incentive effects of WC benefits should (but typically don't) take into account both the tax treatment of WC benefits and these other forms of benefits.

III. Workers' Compensation Effects: Theory[4]

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. Suppose also that firms differ in their production technology, each technology has certain inherent risks of injury associated with it, these risks 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 negatively (due to pain and suffering) the probability of being injured. Workers will move to firms whose earnings-risk of injury combination maximizes their well-being and, if all workers have identical preferences, higher risk of injury firms would have to pay higher wages to attract any 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.[5]

In such a world, firms would choose the wage rate-risk of injury combination to offer so that their marginal cost of injury reduction just equals their marginal benefits from injury reduction. The former includes the costs of resources devoted to preventing accidents, while the latter includes the lower wage bill associated with the lower accident rate, less down time 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 WC benefits that were perfectly experience rated (and contained no loading or administrative charges) would not affect the injury rate at any firm. Rather, since WC benefits would now compensate workers if they were injured, smaller compensating wage differentials would be required to attract workers to high injury rate firms. Thus, higher WC benefits should lead to lower wages at each firm. WC benefits would not affect the optimal injury rate from each firm's perspective since the firm's reduction in wage costs would just be offset by the new WC costs.

Suppose instead, WC benefits were not perfectly experience rated. In this case, the reduction in wage costs due to the payment of WC benefits to workers 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. Imperfect experience rating then would lead to a higher injury rate than would exist either in the absence of the WC system, or in the presence of a WC system that was perfectly experience rated.

Of course all of the above presupposes a perfectly competitive labor market; one in which wage differentials arise to fully compensate workers for risk of injury. In such a world, if workers are risk neutral, there is in fact little rationale for a WC system.[6] If, however, fully compensating wage differentials do not arise, the predicted effects of WC benefits are quite different.

Consider again the case of a perfectly experience rated WC system where employers bear the full costs of the WC benefits paid to their employees. In this situation, where wage differentials do not initially fully compensate workers for risk of injury, employers' marginal costs of injuries would rise in the presence of WC benefits (wages would not fall sufficiently to offset the cost of WC 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.[7]

From the employers' side of the labor market then, the effect of the WC system, or higher WC benefits on employer resources devoted 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 WC is imperfectly experience rated, the injury rate may actually increase. If wage differentials are not fully compensating and the WC system is perfectly experience rated the injury rate will decrease. Empirical analyses are required to resolve the ambiguity.

One should distinguish, however, between employer incentives to increase resources devoted to injury prevention, and thus decrease the injury rate, and employer incentives to reduce both the incidence and duration of WC claims. As long as WC benefits are at least partially experience rated, higher WC benefits increase employers' incentives to both challenge WC claims and to encourage injured workers to speed their

recovery and return to work. Even if increasing WC benefits does not alter employer resources devoted to injury prevention, it may affect the number and duration of WC claims.

The above discussion focuses on the employer side of the labor market. Increasing temporary total WC benefits may also affect injury rates and claims by influencing employee behavior in a number of ways. First, higher WC benefits may reduce the disutility workers feel when they have minor and temporary illnesses. Thus, higher benefits may reduce the precautions they take on the job to prevent types of accidents that are unlikely to lead to serious permanent injuries. Second, higher benefit levels increase employees' incentives to file claims for minor injuries where the need to remain temporarily off the job is ambiguous.[8] 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.

Higher temporary total disability benefit levels may lead from workers' perspectives, then, to increased WC claims. Whether this is due to increased injury rates caused by less worker precaution or to increased probability of filing a claim, given a marginal injury, is important to determine. Higher benefits may also lead to longer durations for individual claims, however this does not imply average claim duration would lengthen. If the higher benefits induce a lot of claims based on less severe injuries, average claim duration might actually fall.

Permanent partial disability benefits may affect WC claim rates and the supply of labor by disabled workers to the market as well. 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 are typically not contingent on work effort after

the benefit determination date; they are specified as a lump-sum or weekly amount. These benefits increase the injured individual's wealth (assuming his 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 lower hours of work and reduced fraction of time in the labor force.

In some states, however, for example New York and Florida, nonscheduled benefits are specified as a fraction of preinjury earnings, or of some estimate of earnings capacity lost, subject to minimum and maximum benefit levels. Benefits here are contingent on work effort and like any income transfer system of this type (e.g., AFDC) higher wage replacement rates encourage reduced labor force participation and hours of work. Furthermore, the formulae used to compute benefits under such systems do not take into account that economic conditions may affect injured workers' earnings prospects; benefit levels do not depend on local unemployment rates. Since higher unemployment rates reduce the actual earnings prospects of some injured workers relative to their nonscheduled permanent partial WC benefits, one would expect permanent partial claim rates for nonscheduled benefits in these states to increase when unemployment rates are high.

In sum, WC benefit levels, operating through both the employer and employee side of the market should be expected to influence the magnitude of compensating wage differentials, employer efforts to reduce injury rates, injury rates per se, the number and types of WC 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.

IV. 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, work days lost due to accident rates, etc.), after other personal characteristics that should influence wages (e.g., education, experience) are controlled for.[9]

These studies uniformly tend to find that there is a positive association between fatal accident rates and wages. However, the relationship between nonfatal accident rates and wages is less well-established; appearing in some studies but not in others. Most studies find that the magnitude of compensating wage differentials is larger in the union sector than the nonunion sector,[10] 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.[11] 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 unfavorable job characteristics like mandatory overtime requirements.[12]

Somewhat surprisingly, most 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 compensating wage differentials. The few studies that have, do find that higher income replacement rates reduce

the magnitude of the wage differential paid for risk of injury.[13] One study has also found that higher risks of injury are associated with higher fringe benefit levels as well as higher wages.[14]

Unfortunately, I believe that 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 I discuss below, I believe answers to neither 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 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 judgements. Many of these factors are probably highly correlated with risk of injury on the job and workers may demand wage premiums to accept them also. 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.[15] When a few investigators have included other working conditions along with risk of injury in wage equations; the risk of injury variables tends not to be significantly associated with wages.[16] Whether this is due to the high collinearity of the working conditions variables (which makes estimates imprecise) or the failure of a wage-risk of injury differential to truly exist 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 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.[17]

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. However, once one allows for market imperfections 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 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 value of lives in the range of $200,000 to $3,500,000.[18] 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. Hence, their potential usefulness for public policy in the occupational safety area is limited. At best, they provide lower-bound estimates of the value of life.

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

In theory, the incidence and duration of work injuries depends both upon employee and employer actions. Given the discussion in section III, 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 in section VII, 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 WC benefit levels on the incidence and duration of injuries and/or WC claims.

The nine studies summarized in Table 1 fall neatly into three groups. First there are three studies by James Chelius ((1973), (1974), (1977)) that use a single year's data and find that, controlling for other factors, higher WC 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) (1983) and one by John Ruser (1984) that use data for a number of years. Chelius (1982) uses data from 36 states for the 1972-75 period and finds that higher WC benefits are associated with more frequent accidents, but fewer days per case, so that on balance they have no association with the total lost work day rate. His later study (Chelius (1983)) uses data for fewer states (28), but a longer period (1972-1978) and finds that while the WC benefit-frequency association is still observed, the benefit-days per case relationship vanishes. As a result, higher benefits are associated with an increased total lost work day rate in this study. Whether the differences in results between the two studies reflect changes in behavior that occurred in 1976-78, or the dropping of 8 states from the sample is not investigated by Chelius.

Fi;nally, Ruser (1984) uses data from 41 states for the 1972-79 period and finds that higher WC 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 report-ing of minor injuries, that otherwise would go unreported, and that tend to be of short duration. They might induce workers to take more risks on the job, but only in situations that will 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 more frequently challenge long-term claims, or to "encourage" injured workers to return to work more rapidly. Presumably data on WC claims challenges are available, however, to my knowledge, no researcher has attempted to analyze if employer challenges of WC claims (either at the outset or while a claim is in progress) are related to the level of WC benefits.

The third group of studies analyze different types of data. Richard Butler (1983) focused on data from one state, South Carolina, over a long time period and found that an index of average real annual WC payments for various types of injuries in the state was positively associated with the frequency of almost all types of injuries. Butler and John Worrall (1983) used WC claims data for 35 states over the 1972-78 period and computed estimates in each state/year of the levels of various types of WC 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.[19]

This latter result is intriguing as it suggests that injured workers have some control over how they attempt to get their claims classified (major or minor injury). This takes us back to the possibility that at least part of the observed WC effect on injury rates may simply be a reporting effect.[20] Evidence to support this view is presented by Worrall and Apley (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) found that frequency rates for injuries that involve no lost days appear not to be sensitive to WC benefit levels; since the waiting period in most states is at least three days, workers have no added incentive to report injuries in this category in the face of higher benefits.[21] He argues that any positive relationship here would indicate a real association between WC benefits and this short-term injury rate and this is not observed. Two studies (Chelius (1982), Butler and Worrall (1983)) also found that longer waiting periods are associated with decreased injury rates or WC claims; whether this is a reporting or real affect was not be ascertained.

Taken together these studies strongly suggest that increases in WC benefits are associated with higher injury and workers' compensation 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 mix, or types, of injuries reported.

To accurately analyze the effects of WC benefit levels on duration of claims requires data on individual WC claims; two studies which do this are discussed in the next section.

The studies described in this section have become methodologically more sophisticated over time, controlling for more variables, and using more refined data. Nonetheless, their conclusions should be probably tempered for at least two reasons. First, conclusions about the effects of WC benefits on injury or injury claim rates are essentially drawn from observations on the association between benefit levels and injury rates across states, or 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 induce pressure to have generous WC 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 visa versa.

Second, the WC system is a complex system which 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 does administrative stringency in processing claims, and the propensity of employers to challenge claims.[22] In contrast to research on unemployment insurance, where these factors have been considered, WC research has tended to ignore them.[23] If these variables are correlated with WC benefit levels, their omission will distort the estimated benefit level-injury rate relationship.

VI. Workers' Compensation Benefit Levels and the Duration of Compensation Claims

In a series of two papers, Richard Butler and John Worrall (1984) and Worrall and Butler (1985) have used data on individual WC claimants in the state of Illinois to analyze the effects of WC benefit levels on the duration of temporary total disability claims.[24] The data is confined to one state to control for other aspects of the WC system and to one type of indemnity claim, those arising from low-back injuries, to mitigate the problem of varying mixes of injury types found in more aggregate data. The data come from a National Council on Compensation Insurance sample of claimants in 12 states, that began in April 1979 and followed the claimants for 42 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 42 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.[25]

Both papers yield the same important result: After controlling for other factors, the higher an individual's income replacement ratio under the WC program, the less likely he is to leave claimant status and hence the longer his expected duration of WC claim. In their preferred specification in one paper, a 10 percent increase in benefits is predicted to increase average claim duration by .23 weeks (or one day), which represents a 2 percent increase in the lengthening of the average claim.[26] Whether this statistically significant result is large enough to be of "policy significance" is left to the reader to evaluate.[27]

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 previous earnings.

To see why this creates problems, consider how the typical WC schedule operates. Referring to the top panel of Figure 1, there is a minimum WC benefit level, B_{min}, in the state. If an individual's pre-injury earnings fall in the range E_{min} to E_{max}, then WC 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 1 shows the implied income replacement rate (B/E) for this schedule. It is constant (at about 2/3 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 an individual faces is an exact inverse function of his previous earnings, one cannot meaningfully speak, at a point in time, of varying the rate independently of previous earnings. If both previous earnings and the income replacement rate appear to influence duration of WC claims, this may reflect only that previous earnings affects duration in a nonlinear fashion. Without independent variation in the income replacement rate we cannot ascertain if we are really estimating the effect of WC benefit levels on duration.

Some independent variation may have in fact existed in the Butler-Worrall data.[28] 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' <u>actual</u> number of claim weeks to obtain a measure of their weekly WC benefits. This approach causes

individuals with randomly long claim durations to have randomly low reported income replacement rates. Hence, Butler and Worrall would understate the true effect of WC benefits on duration. A further problem is that one would expect lump-sum awards to have a different effect on claim durations than a contingent weekly award. Their approach does not permit this to occur.

The conclusion one reaches here is that while the use of data from one state has its advantages, it also creates obvious problems. One senses that data from more than one state is required, although this would require researchers to take other characteristics of the state and state WC 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 that occurs in replacement rates.[29] The 12 state NCCI sample may prove a very useful data base for a similar analysis in the workers' compensation area.

VII. Experience Rating

In spite of the important role that experience rating plays in determining employers' responses (in theory) to an increase in WC benefits, there has been only two published attempts to empirically analyze if experience rating affects injury rates. The sole published study, Chelius and Smith (1983), exploit the fact that small, manually rates, firms are not experience rated, while very large firms are perfectly experience rated. Focusing in a state on firms within a single industry, the difference between injury rates in small and large firms obviously will reflect many factors besides the difference in experience rating. However, other things equal, the higher WC benefits in the state the greater they argue the incentive faced by large firms to reduce their injury rates and

thus the smaller the difference should be. They test if experience rating matters by seeing if, across states, higher WC benefits are associated with lower values of the difference in injury rates between small and large firms in each of 15 2-digit manufacturing industries. They conclude that their data does 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.

Taken at face value their results suggest that the safety effects of experience rating are sufficiently small that policymakers need not worry that many firms face imperfect or no experience rating. One must be cautious, however,in drawing this conclusion for several reasons in addition to the ones the authors offer relating to the nature of the data they use.

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

Second, average wage differences with a 2-digit industry across states may reflect differences in the 3 or 4-digit industry mix across states and there is no reason to suppose that the injury rate-firm size relationship is constant across 3 or 4-digit industries. This makes it difficult, using their method, to separate out the effects of WC benefits from the effects of industry mix.

Finally, average wage differences across states may reflect differences in the large firm/small firm wage rate differential within states.[30] If wage rates differ between firms in a state, injury rates may also differ for reasons completely independent of experience rating.[31]

One senses from all of this that efforts to estimate the effects of experience rating using aggregate state by industry data, even when stratified by firm size, are not likely to prove fruitful. At first glance, a more promising strategy appears to be to obtain data 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 experience rating system rules and characteristics of the firm) and then to test for the effects of this variable on future injury rates at the firm.[32]

Unfortunately, the marginal cost per injury a firm faces, given its size and wages, will depend upon 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.[33]

VIII. Workers' Compensation and Labor Supply

Several studies have addressed the issue of how permanent partial WC benefits affect labor supply, highlighting the distinction between scheduled and nonscheduled benefits.[34] 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 labor supply effects 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 labor supply.

Some support for this view is found in John 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. WC payments in the former case are contingent on wage loss and increases in the unemployment rate make it harder for disabled workers to find jobs that compensate them at the level of their pre-injury jobs.

Burton also found, however, that higher benefit levels reduced the number of nonscheduled permanent partial cases. While it is possible that this reflects employer efforts to prevent injuries or injury claims dominating over any reduced employee actions to promote safety, it must be stressed that this latter result flies in the face of all of the evidence summarized in Table 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 factors which should influence compensation costs and injury rates.[35] 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.

IX. Concluding Remarks

A long critical summary of the literature in an area requires no summary. However, several substantive propositions are worth repeating that have relevance for policy in the occupational safety and health area.

First, the evidence on compensating wage differentials for risk of injury is no where near as solid as producers of the evidence believe. 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 can not be used to draw conclusions about how well markets are working.

Second, higher workers' compensation benefits do appear to 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 challenge more claims. The fact that a positive relationship between frequency and benefits is observed implies that employees' responses to higher benefits dominates, 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. The reason for this is that 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.[36] To the extent that experience rating does matter, this will provide employers with increased incentives to improve safety. Similar proposals have previously been suggested in the overtime pay area--increasing the tax on overtime hours but not the overtime premium paid to workers--and have been supported by at least some unions.[37]

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 we ultimately locate will depend upon policy makers' judgments about the optimal combination of adequacy and safety given the trade-off that researchers have found. For example, taken at face value the results in Chelius (1983) 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 100 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 of other characteristics of the WC system, such as administrative stringency, the frequency of employer challenges, and the frequency of the

use of attorneys in claims cases, on the frequency and duration of claims. Research on the causes of, and effects of, these other characteristics, would clearly help policy makers improve the design of the WC system.[38]

Footnotes

1. Much more detailed discussions of the WC system are presented elsewhere. For example, see John Burton (1983), John Burton and Monroe Berkowitz (1982), Richard Victor (1982), Richard Victor, Linda Cohen, and Charles Phelps (1982), and John Worrall (1983b). My discussion, which is unabashedly pirated from them, is necessarily brief and nontechnical.

2. Burton and Berkowitz (1982), p. 80.

3. A more detailed discussion of experience rating is found in Victor (1982).

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

5. If workers have different degrees of risk aversion, they will sort themselves across firms so that those with the least aversion to risk 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.

6. 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. As a result, in this case the introduction of WC 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 WC benefits, which would decrease employers' incentives to prevent risks. Thus, again the the injury rate might rise relative to that which would prevail in the absence of the system.

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

8. 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 WC claims.

9. The pre-1979 studies are summarized in Robert Smith (1979). Examples of later studies include Charles Brown (1980), Burton (1983), Richard Butler and John Worrall (1983), William Dickens (1984), Richard Freeman and James Medoff (1981), Craig Olsen (1981), Robert Smith and Alan Dillingham (1984), and W. Kip Viscusi (1978) (1979) (1980). Recent attempts that use longitudinal data include Greg Duncan and Bertil Homlund (1984).

10. See Dickens (1984), Freeman and Medoff (1981), Olsen (1981), and Viscusi (1979), for example. Smith and Dillingham (1984) find this result in 1973 data, but not in 1977 or 1979 data.

11. See John Worrall and Richard Butler (1983) and Greg Duncan and Frank Stafford (1980).

12. See Ronald Ehrenberg and Paul Schumann (1984).

13. See Richard Arnould and Len Nichols (1983), Richard Butler (1983), Stuart Dorsey (1983) and Dorsey and Norman Walzer (1983).

14. Dorsey (1983).

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

16. For example, Brown (1980).

17. See Ehrenberg and Smith (1982), pp. 221-222 for examples.

18. See Smith (1979).

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

20. As noted above, Butler and Worrall (1983) find WC 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.

21. Chelius (1982), p. 239.

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

23. Studies of the effects of administrative stringency in the unemployment insurance literature include Gary Solon (1984) and Stanley Horowitz (1977). Studies of the effects of experience rating include Frank Brechling (1981) and Robert Topel (1983).

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

25. See Chris Flinn and James Heckman (1982) and T. Lancaster (1979), for example.

26. Worrall and Butler (1985).

27. They also find that when a lawyer represents a claimant, the duration of claim is longer. This returns us to the whole issue of administrative stringency and legal challenges. Their data permit them to analyze some of the factors that influence the presence of an attorney.

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

29. See, for example, Ronald Ehrenberg and Ronald Oaxaca (1976).

30. Consider the extreme case where small firms in every state paid the same wage. Higher average wage in a state would reflect higher large firm wages and hence a greater small firm/large firm wage differential.

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

32. Victor (1982) has developed such an algorithm.

33. In an unpublished paper, Ruser (1984) also attempts to test for the effects of experience rating on injury rates. He argues that large firms are more likely to be experience rated and thus that higher WC benefit levels should reduce injury rates more in large firms than in small. Empirically he tests whether the effect of WC benefit levels on the average injury rate in a state-industry cell is negatively related to the average size of firms in the cell; and finds some support for this hypotheses.

34. A number of related studies estimate the effect of the social security disability program on labor force participation rates. See, for example, Robert Haveman and Barbara Wolf (1984) (forthcoming), Jonathan Leonard (1979), and Donald Parson (1980a) (1980b) (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.

35. See, for example, Alan Dillingham (1983).

36. Chelius (1982) has previously suggested this.

37. See Ehrenberg and Schumann (1982), Chapter 8, for a discussion of these proposals. The United Automobile Workers (UAW) has been a noted supporter of them.

38. Some suggestive evidence on how the benefits to litigating WC claims varies across states is presented in Butler, Kearl, and Worrall (1984).

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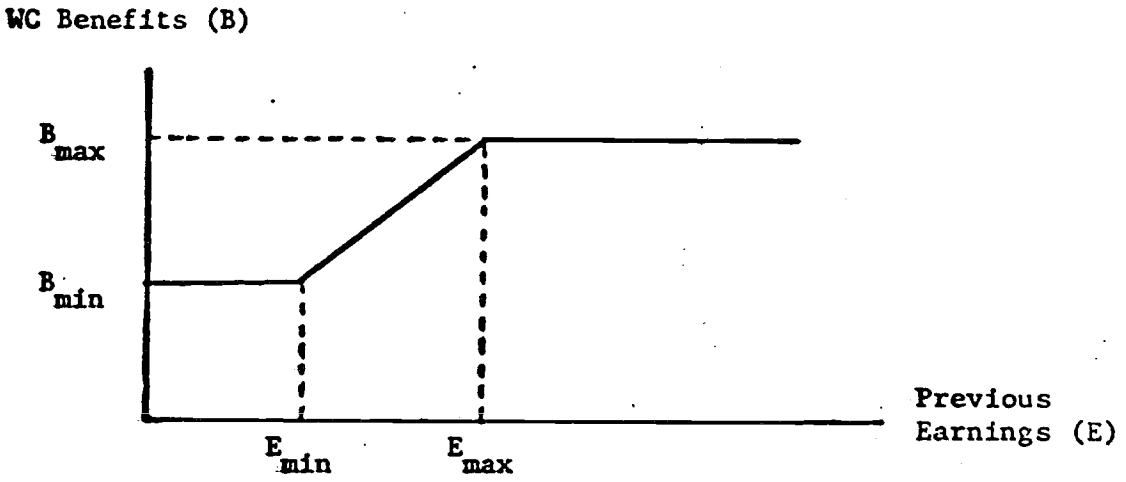
Figure 1

A) WC Benefit Levels



B) WC Income Replacement Ratio

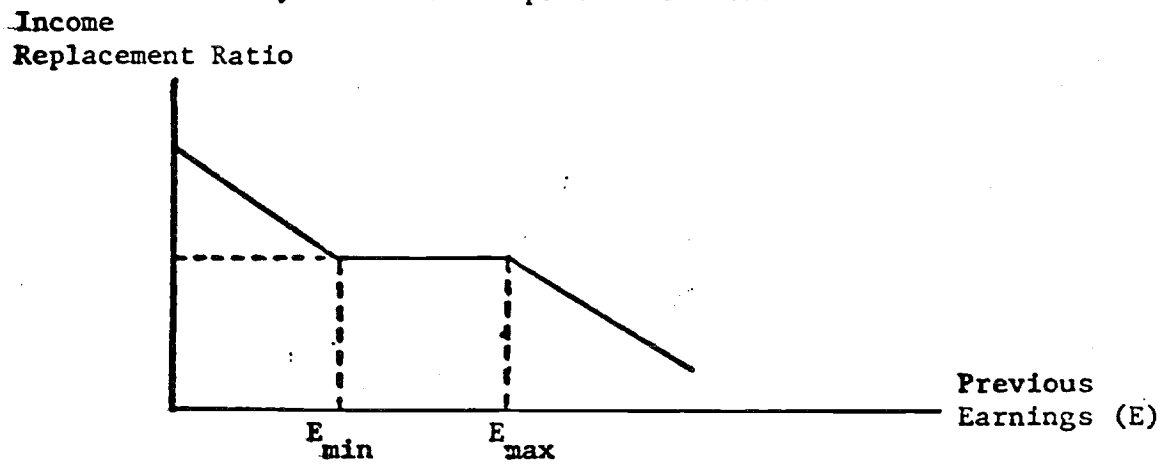


Table 1

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	WC Benefit Variable	Outcome Variables	Effect of Higher Benefit Levels	Other WC Variables Included (Effect of Increase)
Chelius (1973) Chelius (1974) Chelius (1977)	1967 state by manufacturing industry data	WC 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	WC 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)
Ruser (1984)	1972-79 3-digit manufacturing data for 41 states	Average weekly WC 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 WC benefit in the state for a) temporary total b) minor perm. partial c) major perm. partial injuries (computed from state laws, average wage and assumed wage distributions)	NCCI claim rates for non-self-insuring firms for A) temporary total B) minor perm. partial C) major perm. 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 WC payments for various types of injuries	South Carolina Industrial Commission statistics on Lost workday rate Death rate Perm. total rate Perm. partial rate Temp. total injury rate	 Increase Increase Increase Increase No Effect	--
Worrall and Apley (1982)	1958-77 data for the state of Texas	Income replacement rate for temporary total injuries in the state	NCCI data Temp. total claims/ medical only claims All indemnity claims/ medical only claims	 Increase 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.