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# THE EMPLOYERS' COSTS OF WORKERS' COMPENSATION INSURANCE: MAGNITUDES, DETERMINANTS, AND PUBLIC POLICY

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# THE EMPLOYERS' COSTS OF WORKERS' COMPENSATION INSURANCE: MAGNITUDES, DETERMINANTS, AND PUBLIC POLICY


## ABSTRACT

This paper presents estimates of the average cost of the workers' compensation insurance program for a homogeneous group of employers by state. These estimates are of interest because they reflect the operation, direct nominal costs, and efficiency of workers' compensation. The paper estimates cost equations for a variety of alternative specifications. The main finding is that when cost equations are estimated by ordinary least squares there is a unit elasticity of costs with respect to benefits, but instrumental variable estimates of the effect of benefits yield a greater than unit elasticity. The results also indicate that the presence of a state insurance fund is associated with higher average costs to employers, all else equal. Finally, we explore the impact that the minimum standards recommended by the National Commission on State Workmen's Compensation Laws would have on workers' compensation costs.



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## I. Introduction

Workers' compensation insurance is the primary program that provides cash benefits, medical care, and rehabilitation services to workers who are disabled by work-related injuries and illnesses. The program is larger than unemployment insurance, AFDC, and food stamps, as measured by total expenditures (Bixby, 1989). The provisions of workers' compensation insurance, such as coverage and benefit levels, are determined exclusively by the states, which distinguishes workers' compensation from most other social insurance programs in the United States. Also, in contrast to most other social insurance programs, the insurance arrangements in workers' compensation include a mixture of private insurance carriers, state insurance funds, and self-insuring employers.

These distinctive attributes of workers' compensation are the basis for three topics examined in this paper. One topic is the relative cost efficiency of the various insurance arrangements used to provide benefits. Specifically, we examine whether the costs of workers' compensation insurance provided by private insurance carriers in a jurisdiction are affected by the presence of a competitive state insurance fund. The second topic concerns the interstate differences in the employers' costs of workers' compensation insurance. We are interested in the magnitude of these costs in 1983 (the most recent year with data available for all variables in our study), and in how they have changed since 1972. In 1972, the National Commission on State Workmen's Compensation Laws conditionally supported the enactment of federal standards for the program as a means of reducing the disparity in costs and benefits among the states (see National Commission, 1972, p. 26). We estimate the effect such standards would have on the level and dispersion in workers' compensation insurance costs.

Finally, we use the interstate variability in state workers' compensation programs to estimate the relationship between insurance costs and benefits. This relationship is of interest because in the absence of a behavioral response to insurance, costs would rise proportionally with benefits, all else equal. On the other hand, if either employers or employees change their behavior in response to higher benefits, costs may rise more or less than proportionally with benefits.

The paper is organized as follows. We present estimates of the employers' costs of workers' compensation insurance in section II. A simple model that focuses on benefits as the determinants of these costs is presented in section III. This model is then expanded to allow for other institutional factors. In section IV we fit the data on costs to several relevant variables. The empirical work analyzes an unbalanced panel of 29 states for which necessary data are available in four years between 1972 and 1983. In section V we use the estimated reduced form parameters to examine the potential influence of Federal standards for workers' compensation laws on the level and dispersion of workers' compensation costs in these 29 states.

## II. Measuring the Employers' Costs of Workers' Compensation

Until recently, workers' compensation insurance has been a highly regulated line of insurance. The program is primarily financed by insurance premiums paid by employers; about 20 percent of all benefits are paid directly by self-insuring employers.[1] Employers who purchase insurance from private companies or from state insurance funds are assigned to one or more industrial or occupational classifications. Most states follow the uniform classifications prescribed by the National Council on Compensation Insurance (NCCI), or use a roughly comparable classification system. As the basis for our estimates, we have selected 45 widely used insurance classifications that accounted for 62% of all payroll for employers who purchased workers' compensation insurance nationally.[2] Twelve of the selected classifications are manufacturing industries, seven are contracting industries (e.g., concrete work), and the remainder are primarily service and sales industries.

After each of the employer's operations is assigned to a particular insurance classification, an initial insurance rate called the manual rate is located in the state's schedule. Manual rates are stated as a certain number of dollars per $100 of weekly earnings for each employee.[3] As of 1983,

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[1] The ultimate incidence of workers' compensation costs may differ from the party that nominally finances the program. We return to this issue in section V.

[2] This estimate of the extent of payroll covered by the selected classifications is based on data for 36 states which report such information to the NCCI. By 1983, two of the rate classifications were merged, leaving us with 44 insurance classifications. Strictly speaking, our subsequent econometric estimates only apply to these selected insurance classifications.

[3] Our statistical analysis involves the 29 states listed in Table 2. In Utah, workers' compensation premiums are assessed against the full overtime premium, while in the other 28 states in this study, hours of overtime work are valued at the regular hourly wage. Since the overtime premium is a modest portion of payroll, manual rates in Utah were not adjusted for interstate differences in payroll bases. See Burton and Krueger (1986), pp. 130-131.

forty-six states and the District of Columbia had rating systems that could be compared for the 45 insurance classifications that we examine. For each of these jurisdictions, we calculate a weighted average manual rate for the 45 insurance classifications, using the distribution of national payroll among these classifications as the weights.

Most employers, however, do not pay insurance premiums that are solely a product of their payroll times the manual rate for their insurance classification. Insurance premiums are often adjusted to an employer's own accident experience (i.e., experience-rating), premium discounts for quantity purchases, and dividends received from mutual companies or participating stock companies.[4] In addition, by 1983 most states allowed carriers to deviate from the manual rates after obtaining the insurance commissioner's approval, and six states allowed "open competition" among insurance carriers. Using an approach described in detail in Burton and Krueger (1986), we adjust the manual premiums to reflect these factors.[5] The first four columns of Table 1 report weighted averages of manual rates adjusted for experience-rating, premium discounts, deviations, open competition, and dividends.

The estimates of "adjusted manual rates" in Table 1 can be interpreted as the percent of payroll expended on workers' compensation by a homogeneous

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[4]In most of the years we study, data are not available to make state specific adjustments for experience-rating or dividend payments. Since most states use a uniform experience-rating formula we use the national average experience-rating and dividend offset in these states. We use state specific data for states that substantially deviate from the norm. See Burton and Krueger (1986).

[5]The cost measures for the states that allow open competition are adjusted to reflect more recent state-level information on the impact of open competition. The adjusted manual rates for the six states with open competition in effect as of January 21, 1983 are the manual rates shown in Table 3 of Burton and Krueger (1986) times the estimated net impact of open competition shown in Table 7-12 of Hunt, Krueger and Burton (1988).

Table 1: Industry Weighted Averages of Net Costs
and Adjusted Manual Rates by State

| Jurisdiction | Adjusted Manual Rates 1972 | 1975 | 1978 | 1983 | Net Costs 1972 | 1975 | 1978 | 1983 |
|---|---|---|---|---|---|---|---|---|
| Alabama | .479 | .599 | .855 | .905 | .611 | .938 | 1.544 | 2.565 |
| Alaska | .832 | 1.721 | 1.762 | 2.162 | 1.627 | 4.127 | 4.879 | 10.061 |
| Arizona | 1.385 | 2.178 | 2.505 | 1.273 | 2.066 | 3.985 | 5.293 | 3.733 |
| Arkansas | .915 | 1.038 | 1.292 | 1.178 | 1.040 | 1.447 | 2.078 | 2.860 |
| California | 1.102 | 1.406 | 2.135 | 2.103 | 1.755 | 2.746 | 4.816 | 6.826 |
| Colorado | .649 | .654 | 1.210 | 1.094 | .968 | 1.196 | 2.554 | 3.368 |
| Connecticut | .697 | .827 | 1.353 | 1.786 | 1.008 | 1.467 | 2.768 | 5.160 |
| Delaware | .578 | .736 | 1.428 | 1.184 | .835 | 1.304 | 2.922 | 3.354 |
| DC | .737 | 1.404 | 3.502 | 2.208 | 1.219 | 2.847 | 8.199 | 7.717 |
| Florida | NA | NA | 2.641 | 1.396 | NA | NA | 4.793 | 3.606 |
| Georgia | .501 | .760 | 1.077 | .907 | .629 | 1.169 | 1.912 | 2.360 |
| Hawaii | .960 | 1.335 | 2.057 | 3.793 | 1.306 | 2.229 | 3.964 | 11.156 |
| Idaho | .865 | 1.283 | 1.287 | 1.291 | 1.063 | 1.933 | 2.238 | 3.727 |
| Illinois | .657 | 1.002 | 1.382 | 1.046 | 1.029 | 1.925 | 3.063 | 3.316 |
| Indiana | .385 | .417 | .480 | .337 | .576 | .766 | 1.016 | 1.062 |
| Iowa | .451 | .662 | 1.084 | .947 | .644 | 1.159 | 2.190 | 2.966 |
| Kansas | .575 | .766 | .879 | .813 | .767 | 1.253 | 1.659 | 2.303 |
| Kentucky | .668 | 1.065 | 1.382 | 1.120 | .949 | 1.856 | 2.781 | 3.442 |
| Louisiana | NA | NA | 1.512 | 1.339 | NA | NA | 2.909 | 3.964 |
| Maine | .520 | .981 | 1.380 | 1.636 | .687 | 1.588 | 2.581 | 4.495 |
| Maryland | .816 | 1.009 | 1.262 | 1.909 | 1.154 | 1.750 | 2.526 | 5.520 |
| Massachusetts | 1.106 | 1.171 | 1.373 | 1.526 | 1.569 | 2.037 | 2.757 | 4.270 |
| Michigan | .914 | 1.238 | 1.890 | 1.458 | 1.493 | 2.480 | 4.372 | 4.899 |
| Minnesota | .854 | 1.240 | 1.821 | 1.411 | 1.237 | 2.203 | 3.733 | 4.151 |
| Mississippi | .751 | .902 | .902 | .825 | .856 | 1.261 | 1.457 | 1.997 |
| Missouri | NA | NA | .740 | .598 | NA | NA | 1.196 | 1.763 |
| Montana | .948 | 1.565 | 1.404 | 1.589 | 1.330 | 2.695 | 2.795 | 4.993 |
| Nebraska | .529 | .789 | .710 | .793 | .782 | 1.430 | 1.484 | 2.303 |
| New Hampshire | .534 | .746 | 1.166 | 1.351 | .689 | 1.179 | 2.128 | 3.514 |
| New Jersey | 1.224 | 1.233 | 1.687 | 1.422 | 1.872 | 2.312 | 3.651 | 4.357 |
| New Mexico | .787 | 1.069 | 1.441 | 1.967 | .957 | 1.594 | 2.479 | 5.279 |
| New York | .864 | .973 | 1.770 | 1.184 | 1.326 | 1.830 | 3.844 | 3.679 |
| North Carolina | .420 | .433 | .532 | .733 | .501 | .634 | .899 | 1.823 |
| Ohio | .885 | 1.109 | 1.550 | 1.375 | 1.352 | 2.077 | 3.352 | 4.355 |
| Oklahoma | NA | 1.052 | 1.446 | 1.386 | NA | 1.673 | 2.654 | 3.916 |
| Oregon | 1.491 | 2.074 | 2.918 | 1.219 | 2.269 | 3.872 | 6.288 | 3.789 |
| Pennsylvania | .387 | .776 | 1.173 | 1.395 | .554 | 1.365 | 2.382 | 4.146 |
| Rhode Island | .767 | .899 | 1.303 | 1.444 | .993 | 1.427 | 2.387 | 3.648 |
| South Carolina | .609 | .590 | .836 | .942 | .700 | .832 | 1.360 | 2.320 |
| South Dakota | .511 | .635 | .842 | .736 | .706 | 1.077 | 1.649 | 2.194 |
| Tennessee | .664 | .710 | .903 | .767 | .866 | 1.134 | 1.666 | 2.111 |
| Texas | NA | NA | 1.753 | 1.644 | NA | NA | 3.293 | 4.747 |
| Utah | .503 | .766 | .892 | .724 | .678 | 1.267 | 1.701 | 2.116 |
| Vermont | .514 | .588 | .875 | .729 | .684 | .963 | 1.646 | 1.975 |
| Virginia | .391 | .539 | .880 | 1.044 | .478 | .808 | 1.525 | 2.726 |
| West Virginia | .428 | .671 | .660 | 1.162 | .563 | 1.069 | 1.229 | 3.507 |
| Wisconsin | .505 | .581 | .752 | .791 | .751 | 1.060 | 1.582 | 2.480 |
| Mean | .723 | .981 | 1.376 | 1.290 | 1.027 | 1.720 | 2.770 | 3.843 |
| Std. Dev. | .267 | .398 | .621 | .567 | .439 | .839 | 1.465 | 1.956 |

sample of employers. The results indicate, for example, that as of January 1, 1983, the 45 types of employers spent, on average, .905 percent of payroll on workers' compensation premiums in Alabama. The mean cost among all 47 states in that year was 1.290 percent of payroll.

It is also useful to examine the dollar amount of workers' compensation weekly premiums paid per employee. To compare such figures across states, it is necessary to control for differences in the average wage that stem from the state's industrial mix.[6] Consequently, we calculate a weighted average of each state's wage using the individual state's industry wage distribution and the national industry employment distribution. The last four columns in Table 1 present estimates of the "net cost" of workers' compensation insurance, which equals the adjusted manual rate times the "industry-adjusted" state average wage. These figures are in nominal dollars. The table indicates, for example, that the 45 types of employers spent, on average, $2.565 per week per employee on workers' compensation premiums in Alabama in 1983.

## III. A Model of Insurance Costs

A simple model of the determination of workers' compensation costs is presented to guide the empirical work.[7] We assume that all workers have a probability $p$ of incurring a work-related injury that will result in a workers' compensation benefit of $B$ dollars. If the average workers' compensation insurance costs per worker is denoted C, then expected profit for the insurer per covered worker ($\pi$) is $\pi = (1-p)C + p(C-B)$.

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[6] This adjustment is necessary because the numerator -- costs per employee -- is standardized for industrial composition.

[7] We note that Butler and Worrall (1988) develop a more extensive model that allows for variations in the duration of work-related injuries as well.

If insurance rates are actuarially fair the average workers' compensation cost per worker is $C = pB$. It is more realistic, however, to allow for a loading factor that is proportional to workers' compensation rates to cover administrative costs. In this situation, $C = \phi C + pB$, where $\phi$ is the proportional loading factor that is built into workers' compensation rates. The average cost of workers' compensation insurance to employers, therefore, is $C = pB/(1-\phi)$. Taking the natural log of costs gives

(1) $\log(C) = -\log(1-\phi) + \log(p) + \log(B)$ .

So far we have assumed that the probability of a work-related injury is exogenous. If an employee's probability of receiving workers' compensation benefits depends positively (or negatively) on the benefit rate because of reasons discussed below, then insurance costs would rise more (or less) than proportionally with benefits. In particular, if the functional form relating the compensated claims rate and the benefit level is $p = AB^{\gamma}$ , then

(2) $\log(C) = \alpha + (1 + \gamma)\log(B)$

where $\gamma$ is the elasticity of workers' compensation recipiency with respect to average benefits, and $\alpha = \log[A/(1-\phi)]$ is a constant.[8]

This model predicts a log-log relationship between costs and benefits. If the coefficient on the benefit variable in equation (2) is greater than one, there is support for the view that <u>on net</u> employees respond to increased workers' compensation benefits by increasing the number of claims they

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[8]A constant elasticity specification is estimated in most of the previous empirical research on the benefit-claims relationship. See Butler and Worrall (1983), Butler (1983), and Krueger (1988). These papers also provide a choice-theoretic model of work injuries.

successfully file. This increase in claims could come about either through a moral hazard effect, in which workers take less care on the job and incur more work injuries in response to increased income security (the "true injury effect"), or through an incentive to report claims for injuries that would not have been reported in the absence of a sufficient monetary incentive (the "reporting effect"), or a combination of both effects.

A finding that the coefficient on benefits is less than one would support the conclusion that <u>on net</u> increased workers' compensation benefits lead to a safer work environment, perhaps because experience rating causes higher benefits to enhance the incentive for employers to provide safe working conditions. Alternatively, a negative estimate of $\gamma$ may reflect employer or carrier decisions to more aggressively oppose claims in response to higher benefits. Finally, if the coefficient on benefits equals one, there is evidence that on net workers' compensation benefits have no effect on the number of claims. This could come about because the various effects described above are either offsetting or insignificant. Most previous studies, such as Chelius (1977) and Butler and Worrall (1983), have found a positive relationship between benefits and costs, which has been interpreted as evidence of a moral hazard effect.[9]

If the frequency of on-the-job injuries is not affected by the workers' compensation benefit level, it is necessary to control for the injury rate as shown in equation (1) for two reasons. First, a high injury rate may lead to political pressure for high benefits, which would bias the estimate of $\gamma$

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[9] See Kniesner and Leeth (1989) for an analysis of the relative importance of moral hazard and reporting effects. Ehrenberg (1988) discusses the difficulty in distinguishing among the various possible consequences of higher workers' compensation benefits on reported workplace injuries.

unless the injury rate is included in the equation; and second, even if the injury rate and benefit level are uncorrelated, including the injury rate will improve the precision of the estimates. On the other hand, if higher benefits cause more (or fewer) workers' compensation claims, one should exclude the injury rate from the equation to allow its effect to load on the benefit variable. Since it is not clear a priori which assumption is correct, we take an eclectic approach and estimate each equation with and without the injury rate. The work injury rate (p) is derived from the annual OSHA survey of all work-related injuries and illnesses, including those without any lost worktime.[10]

Other Regressors

It is desirable to control for other relevant institutional and economic variables that influence workers' compensation costs in a state. We estimate the simple model in equation (2), and estimate models that include explanatory variables measuring medical benefits, the presence of a competitive state insurance fund, the proportion of the sate's workforce that is unionized, the extent of coverage under the state workers' compensation law, and the proportion of cases accounted for by permanent partial disabilities.

The insurance arrangements that deliver workers' compensation benefits differ from state to state, with variation in the importance of private carriers, competitive or exclusive state funds, and self-insurance. It is widely believed that these types of insurance arrangements influence the costs of workers' compensation. The workers' compensation program is unique among

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[10]Although the workers' compensation claims rate may be a preferable measure of p, it is not available by state in the early years of our sample.

social insurance programs in the extent of private sector involvement in the enforcement of the program, collection of premiums, and delivery of benefits, and thus offers an unusual opportunity to study the relative efficiency of private versus public provision of social insurance.

Although the debate over the proper insurance delivery system ranges over several issues, this study can only estimate the relative cost to employers of insurance purchased in states that allow private sector insurance companies to compete against the state insurance fund.[11] Differences in services, tax liabilities, reserving practices, and reporting requirements that vary among the insurance schemes are not directly accounted for by the model.

One hypothesis is that the presence of a state insurance fund will be associated with higher insurance costs to employers because a state bureaucracy will be inefficient and have some monopoly power. An alternative view, however, is that state-fund insurance is less costly than private insurance because state-operated funds benefit from economies of scale and tax-exempt status, and the absence of a profit motive leads to smaller loading factors.[12] We include a dummy variable indicating the presence of a state fund in our equation to test these hypotheses.

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[11]Because benefit data are unavailable for states with an exclusive state fund, these states are not included in the sample. In addition, we do not consider the importance of self-insurance because all states in our sample allow large firms to self-insure, and the decision to self-insure is endogenous. Our conclusions are qualitatively unchanged, however, when we include a polynomial in the proportion of losses due to self-insured firms in the equations below (this variable is reported in Price, 1986). Butler and Worrall (1983) included a polynomial in the proportion of payroll in nonself-insuring firms to control for selection into the sample.

[12]Millis and Montgomery (1938) and Somers and Somers (1954) provide early discussions of these hypotheses. See Butler and Worrall (1986) for a more recent theoretical and empirical analysis of the returns to scale, efficiency, and hidden costs of public versus private workers' compensation insurance.

Another factor expected to influence the cost of workers' compensation to employers is the extent of unionization. Butler and Worrall (1983) find a positive and statistically significant relationship between unionization and workers' compensation claims. If unions play a critical role providing "voice" in the work-place, this finding is to be expected since unionized workers would be better informed about and more likely to exercise their rights under workers' compensation laws than nonunionized workers. Alternatively, the union rate may be positively related to the injury rate because unions find it easier to organize more dangerous work-places, all else equal. We expect that among the states the proportion of workers unionized will be positively associated with workers' compensation costs.

The fraction of the state's workforce covered by workers' compensation legislation is expected to be related to the employers' costs of insurance. If employees in exempt occupations are at greater risk of work-related disabilities than employees in covered occupations, a greater proportion of covered workers in a state is expected to be associated with greater workers' compensation costs. The opposite result would imply that exempt occupations are safer than covered occupations.

Permanent partial disability benefits are paid to workers with relatively serious injuries, so that losses of actual earnings or of earning capacity continue even after maximum medical recovery. The statutes and practices used to compensate and classify these cases vary widely among the states. We control for this institutional feature by including a variable measuring permanent partial disability cases as a proportion of all cases. Since permanent partial cases account for a disproportionate share of workers' compensation benefit payments, we expect a positive relationship between the relative importance of permanent partial cases and insurance costs. We also expect that higher medical benefits will increase the cost of workers' compensation insurance.

## IV. Data and Results

We fit the workers' compensation costs presented in section II to the institutional and economic variables indicated in the above discussion. Table 2 presents summary statistics and describes the variables. Data are available for 29 states for the years 1972, 1975, 1978 and 1983. Unfortunately, complete data are unavailable for all these states in all years, so the final sample consists of 108 observations.

Because of its importance for the estimation and the policy analysis, we describe the indemnity benefit variable in detail. There are four principal types of workers' compensation indemnity benefits -- temporary total, permanent total, permanent partial, and survivors' benefits.[13] Conditional on filing a successful claim, the expected workers' compensation benefit is determined by the weekly benefit and the discounted duration over which benefits are paid.

The weekly workers' compensation benefit is determined by the nominal replacement rate, the maximum weekly benefit, the minimum weekly benefit, and the weekly wage of the disabled worker. Unless a worker's benefit exceeds the maximum benefit or is less than the minimum benefit, the benefit equals the weekly wage times the replacement rate. The distribution of benefits is doubly censored because workers in the lower tail of the earnings distribution

[13] In many states there are also temporary partial indemnity benefits, but these benefits account for a relatively insignificant share of total workers' compensation payments and are not considered further.

Table 2: Description of Variables

| Variable | Mean (SD) | Definition and Source |
|---|---|---|
| Net Costs | 3.04 (1.70) | Employment weighted average of weekly workers' compensation insurance premiums per employee in 1983 dollars, allowing for experience rating and dividends. Source: calculated by authors. |
| Adjusted Manual Rates | 1.00 (.54) | Net insurance costs per $100 of payroll. Source: calculated by authors. |
| Benefit | 149.44 (33.87) | Average insurance benefit paid for temporary total, permanent total, permanent partial, and fatal workers' compensation cases adjusted for the duration of benefits and waiting and retroactive periods. In 1983 dollars. Source: calculated by authors. |
| Proportion Perm. Partial Cases | .17 (.06) | Permanent partial cases relative to all cases, on a first report basis. Source: NCCI Countrywide Statistics. |
| Injury Rate | .09 (.02) | All work-related injuries and illnesses per full-time equivalent employee, weighted by national industry employment. Source: unpublished tabulations based on OSHA's survey of private sector employers. |
| Medical Benefit Index | 85.30 (23.18) | Average medical benefit paid in temporary total workers' compensation cases divided by 100. Source: NCCI Countrywide Statistics. |
| Coverage Rate | .83 (.07) | Proportion of non-agricultural workers covered by state workers' compensation laws. Source: Daniel Price, Social Security Bulletin, May 1983. |
| Union Rate | .23 (.07) | Proportion of non-agricultural workers who are union members. Source: Bureau of National Affairs and Handbook of Labor Statistics. |
| State Insurance | .25 (.44) | Dummy variable for states with a competitive state insurance fund. Source: Daniel Price, Social Security Bulletin, May 1983. |

Note: Sample size is 108. The states in the sample are: Alabama, Arizona, Arkansas, Colorado, Connecticut, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, North Carolina, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, and Wisconsin.

are paid the minimum benefit and workers in the upper tail are paid the maximum benefit. To estimate the expected weekly benefit from the statutory provisions, we calculate the mean of the censored benefit distribution for each state.[14]

Many states impose limits on the duration of benefit payments or on the total dollar amount of benefits. We apply the NCCI's commutation procedures to discount weekly permanent total and fatal benefits durations for interest, mortality, dollar amount limitations, and escalation of benefits where applicable. The duration index times the expected weekly benefit yields an estimate of the total expected benefit package for the disability class. In addition, we adjust temporary total benefits to reflect the length of the waiting period which is required before benefits begin, and the length of the retroactive period upon which compensation is paid for the waiting period.

Estimates of scheduled and nonscheduled permanent partial benefits for 1972 to 1978 were provided by Butler and Worrall and updated by the authors.[15] These permanent partial benefits calculations take into account the weekly benefit levels as well as the number of weeks for which benefits are payable. For our purposes, the scheduled and nonscheduled benefits were weighted by the relative frequency of those types of injuries in each state and collapsed into an overall permanent partial benefit.

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[14] The distribution of earnings that we use to calculate expected benefits is the national wage distribution centered on each state's average weekly wage. This procedure follows the NCCI's methodology.

[15] The statutes in most states contain a schedule that lists the number of weeks or dollar amounts of benefits paid for the physical loss or the loss of use of specified parts of the body. A scheduled benefit involves any injury specifically enumerated in the statute. Nonscheduled benefits involve injuries that are not included in the statutory list. See Berkowitz and Burton (1987, p. 99).

Because of multicollinearity, it is not sensible to include separate variables for temporary total, permanent total, permanent partial, and fatal benefits. We therefore combined the four benefit variables into one overall benefit measure by weighting each type of benefit by its national claims frequency. This approach to estimating workers' compensation benefits is particularly useful for our purposes because we can impose the National Commission's proposed minimum standards on each state law and actuarially simulate the effect of federal minimum standards on benefits.

Results

Table 3 presents reduced form least squares regression estimates of cost equations using the log of adjusted manual rates as the dependent variable and allowing for a variety of different independent variables. Table 4 contains parallel results using the log of net costs as the dependent variable.[16] The equations are estimated on an unbalanced panel of states from 1972 to 1983.[17] In some specifications we exploit the longitudinal nature of the data and estimate within state (or fixed effects) regressions to control for time-invariant state effects, such as the efficiency of the state administrative agency.[18]

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[16]The log-log specification for costs and benefits seems appropriate for three reasons: first, estimation of the Box-Cox transformation finds that the best fit is approximately log-log; second, a plot of the data reveals a nonlinear, increasing relationship between costs and benefits; and third, the model in section III predicts a log-log relationship between costs and benefits.

[17]We do not include separate year dummies because we want the common time-series variation in benefits to identify the equations. A Chow test of structural change does not reject the hypothesis that the determinants of workers' compensation costs are stable over the years examined at the .01 level for all of the specifications presented in Tables 3 and 4.

[18]Since our sample consists of observations on states that vary greatly in size, there is reason to suspect conditional heteroscedasticity. We therefore performed a series of Breusch-Pagan (1979) tests by regressing the

Table 3: The Determinants of Workers' Compensation Insurance Costs[a,b]

Dependent Variable: Ln (Adjusted Manual Rates)[c]

| Independent Variable | Model (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Intercept | -5.491 (.807) | -5.742 (.857) | -5.825 (.984) | -6.098 (1.041) | -4.838 (1.270) | -4.759 (1.340) |
| Ln (Benefit) | 1.083 (.169) | 1.023 (.174) | .983 (.215) | 1.000 (.216) | .959 (.186) | .954 (.189) |
| Ln (Injury Rate) | --- | .246 (.177) | --- | .159 (.195) | --- | -.036 (.184) |
| Proportion Perm. Partial Cases | --- | --- | 2.542 (.634) | 2.597 (.638) | 1.533 (.962) | 1.548 (.971) |
| Medical Benefit Index | --- | --- | .013 (.018) | .011 (.018) | .002 (.023) | .002 (.023) |
| Coverage Rate | --- | --- | .169 (.566) | .036 (.590) | .966 (.649) | .969 (.654) |
| Union Rate | --- | --- | .408 (.554) | .217 (.602) | -4.873 (1.280) | -4.777 (1.282) |
| State Insurance (1 = yes) | --- | --- | .192 (.087) | .167 (.092) | --- | --- |
| 28 State Dummies | No | No | No | No | Yes[d] | Yes[d] |
| Adjusted $R^2$ | .278 | .278 | .399 | .397 | .780 | .777 |

Notes: a. Standard errors are shown in parentheses.

b. Sample size is 108.

c. Mean (SD) of ln(Adjusted Manual Rates) is -.109 (.463).

d. F-test of the hypothesis that the state dummies jointly equal zero rejects at the .000001 level in columns 5 and 6.

Table 4: The Determinants of Workers' Compensation Insurance Costs[a,b]

Dependent Variable: Ln (Net Costs)[c]

| Independent Variable | Model (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Intercept | -5.063<br>(.807) | -5.542<br>(.800) | -5.234<br>(.908) | -5.701<br>(.953) | -3.185<br>(1.214) | -3.428<br>(1.279) |
| Ln (Benefit) | 1.218<br>(.162) | 1.105<br>(.162) | 1.022<br>(.198) | 1.050<br>(.198) | .812<br>(.177) | .831<br>(.180) |
| Ln (Injury Rate) | --- | .469<br>(.165) | --- | .269<br>(.179) | --- | .111<br>(.176) |
| Proportion Perm. Partial Cases | --- | --- | 2.237<br>(.585) | 2.329<br>(.584) | 1.448<br>(.920) | 1.404<br>(.926) |
| Medical Benefit Index | --- | --- | .025<br>(.016) | .022<br>(.016) | .000<br>(.022) | .000<br>(.022) |
| Coverage Rate | --- | --- | .250<br>(.522) | .024<br>(.540) | .885<br>(.621) | .875<br>(.624) |
| Union Rate | --- | --- | 1.271<br>(.511) | .947<br>(.551) | -3.603<br>(1.125) | -3.899<br>(1.222) |
| State Insurance (1 = yes) | --- | --- | .238<br>(.080) | .195<br>(.084) | --- | --- |
| 28 State Dummies | No | No | No | No | Yes[d] | Yes[d] |
| Adjusted $R^2$ | .341 | .382 | .497 | .503 | .802 | .801 |

Notes: a. Standard errors are shown in parentheses.

b. Sample size is 108.

c. Mean (SD) of ln(Net Costs) is .991 (.467).

d. F-test of the hypothesis that the state dummies jointly equal zero rejects at the .000001 level in columns 5 and 6.

The results indicate that for either measure of workers' compensation costs we cannot reject the null hypothesis that there is a unit elasticity between costs and benefits, regardless of the set of included regressors. The estimated elasticity between benefits and costs is slightly greater than one if state dummies are omitted from the equation, and slightly less than one if state dummies are added to the equation. These results imply that for a given proportional change in indemnity benefits, workers' compensation insurance costs will rise by the same proportion. This finding does not support the generally positive relationship between benefits and the number of reported injuries found in most earlier studies. However, if the state-level benefit variable is measured with error, the elasticity between benefits and costs will be biased downward asymptotically, and the attenuation bias will be greater in the fixed effects models if (as seems likely) the state dummies absorb more of the signal than noise in the benefit variable.

The possibility of an errors-in-variables problem with the benefit variable lead us to use the states' maximum benefit, minimum benefit, waiting period and retroactive period as instruments for the benefit variable.[19] These results are reported in Appendix Table A1 for models without the injury rate. Instrumenting for the benefit variable with these proxies in the adjusted manual rate equations leads the coefficient (standard error) on

squared-residuals of the estimated equations on the total employment of each state; the sample size times the $R^2$ of these ancillary regressions asymptotically follows a chi-square distribution with one degree of freedom. Results of these tests show no evidence of conditional heteroscedasticity. For instance, the chi-square statistic for the test corresponding to the first column of Table 1 is only .08.

[19]These parameters relate to temporary total benefits, which account for the greatest share of cases. A chi-square test of instrument-error orthogonality fails to reject when no covariates are in the equation at the .10 level, but rejects when covariates are included.

benefits to increase to 1.303 (.186) when there are no covariates, and to 1.087 (.202) when state dummies and covariates are included. Similar results are found for net costs. Thus, measurement error may indeed bias the estimate of $\gamma$ downward, and instrumenting for benefits brings our estimates closer to the previous literature. Nonetheless, the estimate of $\gamma$ even after correcting for measurement error is not statistically significantly different from zero in the fixed effects specification.

One explanation for the smaller point estimates of the net injury response to higher benefits in our analysis than in the previous literature is that the additional claims that result from increased benefits have relatively low costs. Such claims would have little effect on our costs measures, but would have a larger effect on measures of injuries that treat all claims equally.

Another key variable is the dummy variable indicating the presence of a state insurance fund. We find that the presence of a state fund is associated with nearly a 20 percent increase in average insurance costs, all else equal. Moreover, this conclusion is unchanged when either measure of costs is the dependent variable. Since no state added or eliminated a competitive state insurance fund in the period covered by our sample, we can not estimate the effect of the state fund once the 28 state dummy variables are included in the model unless additional covariance restrictions are made.[20]

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[20]Hausman and Taylor (1981) show that the effect of a variable that is constant over time can still be estimated in a fixed effects specification if one of the included variables is uncorrelated with the time-invariant component of the error term and correlated with the variable of interest. Amemiya and MaCurdy (1986) and Breusch, Mizon, and Schmidt (1989) derive consistent estimators in this context based on stronger identification assumptions. In the present application, however, it seems to us that there is no legitimate covariance restriction to use to identify the effect of a state fund in the fixed effects specifications.

As expected, the models that include the log of the injury rate typically find a positive relationship between reported injuries and the cost of workers' compensation insurance. The coefficient on the log injury rate is substantially less than one, however, possibly due to inaccurate reporting of work injuries to the Occupational Safety and Health Administration. When the coefficient on the injury rate is constrained to equal one, the other coefficients retain the same sign and are of similar magnitude.

The proportion of cases that are classified as permanent partial disabilities has the expected positive sign. The variable becomes statistically insignificant when the state dummies are added, however. Curiously, we find that the union membership rate has a positive effect on costs in the regressions without state dummy variables, but has a sizable negative impact when we include the state dummies. One possible explanation for this pattern is that in the fixed effects specification the union rate is identified by within state time-series variation in union membership, and over this time period the union rate was generally trending down while workers' compensation costs were trending up. The coefficients for the medical benefit index and the coverage rate are consistently positive and consistently statistically insignificant.

## V. Federal Standards and Workers' Compensation Insurance Costs

The National Commission on State Workmen's Compensation Laws concluded that, "State workmen's compensation laws in general are inadequate and inequitable" (National Commission, 1972, p. 119).[21] The National Commission

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[21] The conclusion that workers' compensation benefits are inadequate is also supported by empirical work by Viscusi and Moore (1987).

proposed that all states voluntarily incorporate 19 essential recommendations into their workers' compensation laws to rectify the inequity and inadequacy of the program. Moreover, if the states failed to adopt these recommendations, the Commission endorsed the passage of federal minimum standards to encourage compliance with its recommendations. The justification for federal standards offered by the National Commission was that their enactment "will remove from each State the main barrier to effective workmen's compensation reform: the fear that compensation costs may drive employers to move away to markets where protection for disabled workers is inadequate but less expensive" (National Commission, 1972, p. 27).

Several objections can be offered to this justification. Perhaps most important, higher benefits in a state could be offset by lower wages, and therefore employers in high benefit states would not be at a competitive disadvantage. However, while there is evidence of a trade-off between benefits and wages, the results are not compelling that benefit increases are fully offset by lower wages (see Ruser, 1985, Viscusi and Moore, 1987, and Hamermesh and Wolfe, 1989). Employers certainly act as if they will bear the burden of higher benefits, and they effectively lobby many legislators (National Commission, 1972, p. 125).[22]

We will not attempt to resolve the issue of the incidence of workers' compensation costs in this paper. There is another argument against federal standards, however, that we will address. The implicit assumption underlying the National Commission's assertion that federal standards will reduce interstate differences in costs is that states with low benefits have low

[22] On September 22, 1987, for instance, the Wall Street Journal (p. 1) reported that, "Wide differences in [workers' compensation] benefits from state to state ... draw corporate fire."

costs, and therefore forcing these states to improve benefits will decrease dispersion in costs. If, however, low benefit states already have relatively high costs, then federal standards will only increase the dispersion in costs among states and thus defeat the basic rationale for standards.

We use the estimated elasticity of costs with respect to benefits to simulate the impact that proposed national standards for workers' compensation benefits would have on the level and dispersion in employers' direct costs of workers' compensation insurance. Specifically, we focus on the eight essential recommendations that directly affect indemnity benefits. These recommendations require the maximum benefit to be at least 100 percent of the state average weekly wage for temporary total, permanent total, and fatal cases, and require a replacement rate of at least two-thirds the gross weekly wage for these cases. In addition, the recommendations require temporary total, permanent total, and fatal benefits to be paid for the duration of the disability, or for life, without any limitations on the total dollar amount.

The actuarial methods described in section III were used to estimate the expected, discounted value of benefits for a successful claim in each state assuming that the essential benefit recommendations were fully adopted and enforced. State laws that did not meet the standards were brought up to the level of the National Commission's recommendations, while provisions that already met or exceeded the minimum standards were not altered.[23] Our estimates predict that in 1972 workers' compensation benefits would have been 36 percent greater than actual costs on average in the 29 states if the eight

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[23] In accordance with compliance evaluation criteria established in <u>Full Compliance of State Laws with Workers' Compensation Recommended Standards</u> (Washington, DC, 1976) maximum weekly benefits were set at the average weekly wage of workers covered by the unemployment insurance program two years prior to the year considered.

essential benefit recommendation were incorporated into each state law. By 1983, compliance with the benefit recommendations would have increased benefits by an average of 14 percent.

Our approach to estimating the effect of compliance with minimum standards on insurance costs is based on the equations estimated in Tables 3 and 4:

$$(3) \quad \log(C_i) = X_i' \beta_1 + \beta_2 \log(B_i) + \varepsilon_i$$

where $X_i$ is a vector of independent variables, $B_i$ is the average benefit leve in state i, $\varepsilon_i$ is an estimation error, and $\beta_1$ and $\beta_2$ are coefficient vectors Assuming the parameters and control variables remain constant, the "simulated log cost of workers' compensation insurance for state i is

$$(4) \quad \log(\tilde{C}_i) = X_i' \beta_1 + \beta_2 \log(\tilde{B}_i) + \varepsilon_i$$

where $\tilde{C}_i$ is the "simulated" average cost, $\tilde{B}_i$ is the expected benefit in state i under full compliance with the minimum standards, and all other variables and parameters are defined as before.

The difference between the log of workers' compensation costs assuming full compliance with the benefit standards and the log of actual costs is

$$(5) \quad \log(\tilde{C}_i) - \log(C_i) = \beta_2 [ \log(\tilde{B}_i) - \log(B_i) ] .$$

Intuitively, this equation makes sense because if benefits are unchanged by national standards, there is no change in costs. Finally, we solve equation (5) for $\tilde{C}_i$ to obtain:

$$(6) \quad \tilde{C}_i = \exp ( \log(C_i) + \beta_2 [ \log(\tilde{B}_i) - \log(B_i) ] ) .$$

The mean, standard deviation, and coefficient of variation for the simulated and actual costs based on equation (6) are presented in Table 5. The simulated costs were estimated under two extreme assumptions: first, using the elasticity ($\beta_2$) estimated in the most parsimonious model (model 1 of Tables 3 and 4); second, using the elasticity estimated in the within state analysis (model 6 of Tables 3 and 4).

As to be expected, the simulation results indicate that the direct cost of workers' compensation insurance to employers would have increased in our sample if the National Commission's recommendations were adopted. The evidence regarding the effect of national standards on the dispersion in costs across states, however, is mixed. In the 1970s the simulations suggest that national standards would have increased the standard deviation in workers' compensation costs, while in 1983 the standard deviation would have been reduced. Furthermore, in every year the coefficient of variation is lower under the assumption that states would have complied with the National Commission's proposed minimum standards. Since adjusted manual rates and net costs have an approximately log normal distribution, the coefficient of variation may be the most appropriate measure of dispersion in this situation.

Several caveats are in order regarding the robustness of the simulated costs. First, the volume of litigation may initially increase following enactment of federal minimum standards due to the uncertainty that accompanies changes in the law. And second, the parameters and structure of the models may change if national minimum standards are actually established. As a result, we take the simulated costs as a rough indication of the consequences of federal standards rather than a precise estimate.

Table 5: Simulation for National Standards and Actual Workers' Compensation Costs -- Summary Statistics by Year[a]

A. Adjusted Manual Rates

| Year | | Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|
| | Actual | .699 | .270 | .386 |
| 1972 | Model 1 | .971 | .343 | .353 |
| | Model 6 | .932 | .329 | .353 |
| | Actual | .935 | .436 | .466 |
| 1975 | Model 1 | 1.078 | .456 | .423 |
| | Model 6 | 1.059 | .451 | .426 |
| | Actual | 1.232 | .560 | .455 |
| 1978 | Model 1 | 1.322 | .579 | .438 |
| | Model 6 | 1.310 | .574 | .438 |
| | Actual | 1.194 | .621 | .520 |
| 1983 | Model 1 | 1.345 | .607 | .451 |
| | Model 6 | 1.325 | .608 | .459 |
| | Actual | 1.015 | .530 | .522 |
| All | Model 1 | 1.179 | .525 | .445 |
| | Model 6 | 1.157 | .524 | .453 |

-- Continued --

Table 5 -- Continued --

B. Net Costs[b]

| Year | | Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|
| 1972 | Actual | 2.287 | 1.001 | .438 |
| | Model 1 | 3.296 | 1.282 | .389 |
| | Model 6 | 2.926 | 1.157 | .395 |
| 1975 | Actual | 2.929 | 1.534 | .524 |
| | Model 1 | 3.429 | 1.606 | .468 |
| | Model 6 | 3.254 | 1.563 | .480 |
| 1978 | Actual | 3.679 | 1.919 | .522 |
| | Model 1 | 3.989 | 2.013 | .505 |
| | Model 6 | 3.875 | 1.966 | .507 |
| 1983 | Actual | 3.429 | 1.865 | .544 |
| | Model 1 | 3.914 | 1.818 | .464 |
| | Model 6 | 3.746 | 1.831 | .489 |
| All | Actual | 3.081 | 1.688 | .548 |
| | Model 1 | 3.655 | 1.705 | .466 |
| | Model 6 | 3.450 | 1.681 | .487 |

a. Sample size is 29 states each year. Estimates for model 1 assume the cost-benefit elasticities estimated in the first column of Tables 3 and 4, and estimates for model 6 assume the elasticity estimated in column 6 of Tables 3 and 4. See text for further details.

b. In 1983 dollars.

## VI. Conclusions

The results of our analysis of workers' compensation costs support three main conclusions. First, when cost equations are estimated by OLS the elasticity of workers' compensation costs with respect to benefits is statistically indistinguishable from one. Instrumental variable estimates of the cost-benefit elasticity are greater than one, but still smaller than would be expected based on estimates of the claims-benefit elasticity in the past literature. One possible explanation for this finding vis-a-vis the previous research is that higher workers' compensation benefits may induce claims that are relatively minor and of small cost. If this were the case, the elasticity of costs with respect to benefits would be less than the elasticity of claims with respect to benefits.

Second, after controlling for factors such as the benefit level and injury rate, workers' compensation insurance costs are higher in states that have state-operated insurance funds competing with private carriers than in states with only private insurance carriers. There are several possible explanations for this finding, including the possible inefficiency associated with a state bureaucracy, and omitted variables that are correlated with the presence of state insurance funds and workers' compensation costs. Clearly, the sources of this relationship should be examined further before policy actions are taken.

Finally, our simulations indicate that the federal minimum standards proposed by the National Commission on State Workmen's Compensation Laws would increase the average costs of workers' compensation insurance and decrease the coefficient of variation among the states in all time periods. The impact of the minimum standards on the standard deviation of costs is mixed; for 1983 and for the four years combined the standard deviation for either cost measure would be decreased by the standards, but in the three other years studied the standard deviation would increase. As a result, the success or failure of the National Commission's prescription to narrow the dispersion in workers' compensation costs among the states by requiring minimum federal standards appears dependent on the time period of interest and the measure of dispersion used.

Table A1: Instrumental Variable Estimates of the Effect of Benefits[a,b]

| Independent Variable | Dependent Variable | | | | | |
|---|---|---|---|---|---|---|
| | Log Adjusted Manual Rates | | | Log Net Costs | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Intercept | -6.486<br>(.926) | -7.653<br>(1.123) | -5.537<br>(1.344) | -5.740<br>(.884) | -6.635<br>(1.029) | -3.689<br>(1.284) |
| Ln (Benefit) | 1.303<br>(.186) | 1.445<br>(.253) | 1.087<br>(.202) | 1.354<br>(.178) | 1.375<br>(.232) | .905<br>(.193) |
| Proportion Perm. Partial Cases | --- | 2.557<br>(.648) | 1.482<br>(.965) | --- | 2.249<br>(.594) | 1.409<br>(.922) |
| Medical Benefit Index | --- | .025<br>(.018) | .005<br>(.022) | --- | .034<br>(.017) | .003<br>(.022) |
| Coverage Rate | --- | -.446<br>(.603) | .914<br>(.652) | --- | -.221<br>(.533) | .845<br>(.623) |
| Union Rate | --- | .145<br>(.571) | -4.666<br>(1.187) | --- | 1.070<br>(.523) | -3.451<br>(1.134) |
| State Insurance (1 = yes) | --- | .152<br>(.089) | --- | --- | .207<br>(.082) | --- |
| 28 State Dummies | No | No | Yes | No | Yes[d] | Yes[d] |
| $\chi^2$ Overident. Statistic (DF=3) | 5.72 | 13.61 | 9.86 | 5.38 | 11.23 | 11.61 |

Notes:

a. Excluded instruments for the benefit variable are log of the maximum benefit, log of the minimum benefit, waiting period, and retroactive period.

b. Sample size is 108. Standard errors are shown in parentheses.

c. Mean (SD) of ln(Net Costs) is .991 (.467).

d. F-test of the hypothesis that the state dummies jointly equal zero rejects at the .000001 level in columns 5 and 6.

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