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Workers' Compensation and Injury Duration: Evidence from a Natural Experiment

By BRUCE D. MEYER, W. KIP VISCUSI, AND DAVID L. DURBIN*

This paper examines the effect of workers' compensation on time out of work. It introduces a "natural experiment" approach of comparing individuals injured before and after increases in the maximum weekly benefit amount. The increases examined in Kentucky and Michigan raised the benefit amount for high-earnings individuals by approximately 50 percent, while low-earnings individuals, who were unaffected by the benefit maximum, did not experience a change in their incentives. Time out of work increased for those eligible for the higher benefits and remained unchanged for those whose benefits were constant. The estimated duration elasticities are clustered around 0.3–0.4. (*JEL* C90, H51, J28)

Workers' compensation can influence the incentives workers face in several ways. Higher benefit rates may decrease workers' incentives to avoid injuries, may increase the incentives to file for compensation for any given job injury, and may foster more claims for nonwork injuries. In addition, higher benefits may make extending the duration of a claim more attractive. Most previous work on incentive effects of workers' compensation has focused on the program's effect on injury rates or the number of claims rather than the duration of claims.[1]

This emphasis may have led to an underestimation of the extent of the effect of workers' compensation on incentives. Higher benefits might induce workers to stay out of work longer either to complete medical recovery or to have more leisure.[2] Such changes may occur even if care and injury levels on the job are unaffected by workers' compensation. In this paper, we address one aspect of the incentives created by workers' compensation using data from a natural experiment provided by two large increases in benefit levels in Kentucky and Michigan. This natural experiment enables us to compare the behavior of people who are injured before the benefit increases to those injured after the increases, providing a test of the effect of benefit changes on the duration of claims.

The motivation for our approach is the observation that, within a given state at a point in time, the weekly benefit for temporary total disability is a piecewise linear increasing function of previous earnings. Since previous earnings strongly influence the payoff from returning to work, the economic benefits of returning to work and the economic gains from receiving benefits are

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[1]See Ronald G. Ehrenberg (1988), Alan B. Krueger (1990a), and Michael J. Moore and Viscusi (1990 Ch. 2) for surveys of previous studies.

[2]Higher benefits may also lead to fraud and overstated claims. For anecdotal evidence on the extent of such behavior see *The New York Times* (29 December 1991, p. 1).

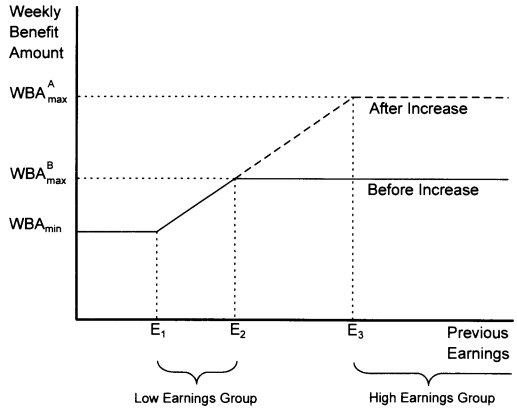

FIGURE 1. TEMPORARY TOTAL BENEFIT SCHEDULE BEFORE AND AFTER AN INCREASE IN THE MAXIMUM WEEKLY BENEFIT

each largely influenced by a common variable, previous earnings. Regressions of spell length on weekly benefits and previous earnings consequently cannot easily distinguish between the effect of workers' compensation and the highly correlated influence of previous earnings. This result is especially true if we are uncertain about exactly how previous earnings affect spell length.[3]

The main idea behind our solution to this problem can be seen in Figure 1, which displays a typical state schedule relating the weekly benefit amount (WBA) for temporary total disability[4] to previous weekly earnings. The solid line is the schedule prior to a change in the state law that raises the maximum weekly benefit amount. The dashed line is the schedule after the benefit increase. For people with previous earnings of at least E_3 (the high-earnings group), we compare the weeks of benefits received for people injured during the year before and the year after the change in the benefit schedule. Those whose claims began before the increase receive WBA^B_{max} while those injured afterwards receive WBA^A_{max}. This group of workers consequently experiences the full effect of the benefit increase. An individual's injury date determines his temporary total disability benefit amount for the entire period of the disability.[5] For example, two individuals with previous earnings greater than E_2 will receive different weekly benefit amounts for up to several years, if one was injured a few days before and the other a few days after the effective date of the benefit increase. The effect of this difference is the basis of the empirical test used in the paper. Most of the remaining methodological problems involve correcting for possible differences between the individuals who are injured before and after the benefit increase. In much of what follows, we will use as a comparison group those with earnings between E_1 and E_2 (the low-earnings group) who are injured during the year before and after the benefit increase. The benefits these individuals receive are unaffected by the increase in the maximum weekly benefit.

Section I briefly outlines the structure of workers' compensation and describes the benefit changes in Kentucky and Michigan that provide the basis for this paper. In Section II we describe the data and outline the empirical procedure used to relate the policy shifts to the incentive effects. The two modes of analysis, assessment of mean effects resulting from the policy shifts and regression analysis of durations, appear in Sections III and IV. By comparing changes in duration and changes in medical expenditures we are also able to distinguish the spell-duration effect of higher benefits from the effect of changes in injury severity. Section IV also reports more precise estimates using all of the available data without mak-

[3]This identification problem created by the dependence of program generosity on an individual's previous earnings is common to many social insurance programs. See Meyer (1989) for a parallel paper on unemployment insurance that builds on earlier work by Kathleen P. Classen (1979) and Gary Solon (1985).

[4]Temporary total disabilities are those where the employee is unable to work but is expected to recover fully and return to work. The types of benefits are discussed in more detail in Section I.

[5]Some states have cost-of-living adjustments which index the benefit for inflation. The two states examined here, Kentucky and Michigan, did not have such adjustments during the period examined.

ing strong functional-form assumptions. As we indicate in the concluding Section V, the incentive effect of the benefit shifts is quite substantial. In particular, while we find a range of estimates, the central tendency of our estimates suggests that a 10-percent increase in the benefit level is associated with an increase in spell durations of 3–4 percent.

I. Workers' Compensation Laws and the Benefit Increases

Workers' compensation programs are run by the individual states and differ widely in their coverage, types of benefits, levels of benefits, and available methods of insurance underwriting. Workers' compensation provides both payments for medical care and indemnity (cash) benefits for work-related injuries. By far the most common type of indemnity payments are those for temporary total disabilities. This paper concentrates on temporary total disability claims, as do the earlier papers in the literature on the duration of workers' compensation claims. A person with a temporary total disability is unable to work but is expected to recover fully and return to work. These claims accounted for more than 80 percent of the recent indemnity claims in the two states analyzed below.[6] However, temporary total claims account for a smaller fraction of total costs.[7] Most importantly for this study, temporary total claims have no fixed duration; their length is determined by the injured worker, his or her doctor, the employer, and its insurer. While not the case in the two states analyzed below, some states have a maximum duration or maximum amount of total benefits. The vast majority of other indemnity claims are for permanent partial injuries. A person with a permanent partial injury is permanently impaired but not completely disabled.

The selection of the state benefit increases used in this study was relatively straightforward. There were only three large increases in the temporary total maximum benefit levels in the states and time periods included in the NCCI data base used in this study. These increases occurred in Florida, Kentucky, and Michigan. The Florida increase coincided with a major overhaul of the workers' compensation law, so that the before versus after comparisons reflect multiple aspects of the change in benefit structure.[8] Because of this complication, we analyze only Kentucky and Michigan.

The Kentucky increase of July 15, 1980, raised the maximum benefit from \$131 to \$217 per week, a 66-percent increase (52 percent over one year in real terms).[9] The replacement rate of $66\frac{2}{3}$ percent did not change. The minimum weekly benefit fell by

[6]See Table 3 for a breakdown of benefit types in Kentucky and Michigan. We include a larger fraction of claims in the temporary total classification than other sources because we use benefit type as of 42 months rather than classifying as permanent all claims longer than one year, as is done in the commonly cited National Council on Compensation Insurance (NCCI) figures.

[7]Over the two-year period examined, claims with only temporary total benefits accounted for 41 percent of all indemnity and medical payments in Kentucky and 68 percent of all such payments in Michigan. These numbers are based on tabulations from the Detailed Claim Information (DCI) data described in Section II. The percentages are much larger than the fraction of costs typically attributed to temporary total claims, since the commonly cited data classifies as permanent all claims longer than one year.

[8]Florida raised its maximum benefit amount from \$130 per week to \$195 on August 1, 1979, but this coincided with a complete reform of the Florida workers' compensation law. A wage-loss system was adopted which eliminated benefits if an individual made more after reaching maximum medical improvement than he or she had previously. Initial interpretations of the new law made it difficult for workers to demonstrate that they had certain impairments, particularly those not listed in American Medical Association (AMA) guides. Many minor permanent partial cases were eliminated from the program. The reform also sought to reduce the frequency of lump-sum settlements, by not allowing them to be considered until six months after the worker had reached maximum medical improvement. For descriptions of the Florida reform see Monroe Berkowitz and John F. Burton, Jr. (1987) and LaVerne C. Tinsley (1980).

[9]The nominal increase in the Kentucky maximum was 65.65 percent. Accounting for one year of inflation at 8.95 percent cuts the increase to 52.06 percent ([165.65/1.0894] − 100).

60 cents from $44.00 to $43.40. Permanent partial scheduled injuries[10] were replaced by payments determined by multiplying the weekly benefit for permanent partial disability by the percentage of disability or the loss in wage-earning capacity, whichever was greater (see Tinsley, 1981 p. 54). Only a small fraction of claims were affected by this change as indicated by the distribution of benefit types reported below. There were some much smaller changes in temporary total benefits on January 1, 1980 and January 1, 1981.[11]

The Michigan increase on January 1, 1982, raised the maximum benefit from $181 to $307 per week, a 70-percent increase (57 percent in real terms).[12] The minimum benefit of $144 was eliminated, and the replacement rate was changed from $66\frac{2}{3}$ percent of pretax wages to 80 percent of after-tax wages.[13] The change in the benefit schedule was not quite as simple as Figure 1 suggests, since benefits depended partly on tax filing status and the number of dependents,[14] as well as previous earnings. Fortunately, the natural experiment was not complicated since the benefit levels for those in the low-earnings group (earnings between E_1 and E_2 in Fig. 1), that we use as a comparison group, did not change. This constancy was due to a grandfather clause stipulating that if an employee was eligible for a larger benefit under the old benefit schedule, the employee was entitled to that benefit under the new law (see Michigan Department of Labor, 1989 p. 28). In practice, this rule meant that the old replacement rate was applicable to people in the low-earnings group. The barely noticeable change in the mean replacement rate for low-earnings individuals discussed below corroborates this constancy.

One policy that does slightly influence the character of the natural experiment is that under the new Michigan law the earnings level needed for the new maximum weekly benefit amount (E_3) differed across individuals depending on tax filing status and the number of dependents. Since we do not have information on tax status or dependents, we use a uniform level of $600 for E_3. At this cutoff point, a single person with no dependents would receive a $305 benefit rather than the $307 maximum, and a married person filing a separate return with no dependents would receive $276. Almost all others received the $307 maximum. These provisions probably account for the increase in average benefits for the high-earnings group reported below being quite a bit less than the 57-percent real increase in the maximum.

There are no previous-earnings requirements for the receipt of workers' compensation, and individuals are covered as soon as they start a job. In Kentucky, Michigan, and most other states, insurance is provided by private insurers and self-insurers. If a firm meets certain requirements, it can choose to self-insure (i.e., pay the costs of all medical

[10]Permanent partial injuries are commonly divided into scheduled and nonscheduled injuries. Scheduled injuries are listed in the state law where a specific amount of compensation is specified. These injuries involve loss of an arm, leg, hand, finger, or other member of the body. Benefits for nonscheduled injuries are determined by multiplying an impairment percentage by a weekly benefit amount.

[11]On January 1, 1980, the maximum rose from $121 to $131, and the minimum rose from $40 to $44. On January 1, 1981, the maximum rose from $217 to $233.26, and the minimum from $43.40 to $46.65.

[12]The nominal increase in the Michigan maximum was 69.61 percent. Accounting for one year of 7.76-percent inflation cuts the increase to 57.40 percent ([169.61/1.0776] − 100).

[13]Kentucky and Michigan differ as to the period over which previous earnings are measured. In Kentucky, the period is the 13 most favorable weeks in the 52 weeks preceding the date of injury. In Michigan, the period is the best 39 weeks in the 52 weeks immediately preceding the date of injury.

[14]There were dependents' allowances under both the old and new law which caused some very slight changes in benefits. Under the old law, dependents' allowances raised the benefit for an individual at the minimum benefit amount by $3 per dependent, up to a maximum of five dependents. Someone at the maximum benefit received $5 for the first dependent and $6 for each of the next four dependents. Under the new law, each dependent raised benefits by about $7 at the maximum, and by about $4 at the old minimum.

and indemnity benefits). In Kentucky about one-fourth and in Michigan about one-half of all dollars of benefits are paid by self-insurers (see Daniel N. Price, 1984; William J. Nelson, 1988). In Michigan there is also a competitive state fund that offers insurance. Our data described in Section III include the Michigan state fund, but not self-insurers.

Other characteristics of state workers' compensation laws that affect the benefits workers receive include the waiting period, retroactive period, and the rules on choice of physician. The waiting period is seven days in both states, which means that no compensation for lost work time is paid for injuries lasting less than seven days. There is a two-week retroactive period in both states that provides compensation for those first seven days if an injury lasts more than two weeks. In Kentucky the employee has the right to choose the attending physician, while in Michigan the employer has the initial choice. After the first ten days of treatment the employee can choose his or her own physician by giving notice to the employer.

While workers' compensation benefits create an incentive for workers to prolong their time out of work, experience-rating creates incentives for firms to monitor the duration of their workers' claims. Characterizing the incentives that firms face is difficult, as experience-rating varies by firm size, industry, and state. While summary measures of the distribution of incentives created by experience-rating are unavailable, some broad generalizations can be made. The incentive to monitor claims rises with firm size. While small firms pay for only part of the cost of additional claims, larger firms may pay more than the cost of a claim through higher premiums (see Richard B. Victor, 1985). The commonly used experience-rating formulas (see National Council on Compensation Insurance, 1988) rely more on the incidence of claims than their severity. Claims exceeding $2,000 are typically downweighted in the calculation of a firm's past experience. Overall, most employees are at firms with fairly strong incentives to monitor the length of claims.

Claims durations are mostly at the discretion of an employee and his or her doctor. If an employer or an insurance company questions the length of a claim, it can request an updated medical report and even request an examination by its own doctor. If the company is not satisfied with the results, it can give notice that it is terminating the payment of benefits. This action will very often lead to a dispute.

The two states have different administrative procedures to resolve disputes. In Kentucky, if the employer and employee are unable to reach an agreement on the nature of compensation, the parties can apply for a hearing. A workers' compensation board member renders an opinion, subject to the approval of the full board. Appeals can be brought to the Circuit Court, and then the Court of Appeals. Michigan has a two-tier structure for decision-making when the employer and employee cannot reach an agreement. Initial hearings are conducted by an Administrative Law Judge. Either party can appeal the judge's decision to the Workers' Compensation Appeal Board.

II. Data and Methods

The data source for this study is the Detailed Claim Information (DCI) data base collected by the National Council on Compensation Insurance (NCCI) (see NCCI, 1984). Data from ten states beginning in 1979 are available, with data from six additional states available over a more limited time period. The data set contains a random sample of indemnity claims from a group of insurance companies which account for over 99.5 percent of the insurance sold in the states. The sampling rates from this population of claims are 0.4 for Kentucky, and 0.2 for Michigan.

The key variables in the data set that we use are date injured, duration of temporary total benefits, total medical costs, previous earnings, weekly benefit amount, benefit type (i.e., temporary total or permanent partial), type of injury (body part affected and the type of damage), whether the claim is settled by a lump sum, age, sex, marital status, and an industry code. A report con-

taining these and additional variables is made six months after the claim is filed, then at 18 months, 30 months, and 42 months after filing, and periodically thereafter. We use the information available after 42 months. The measure of duration is weeks of temporary total benefits paid plus anticipated future weeks paid if the claim is still open. Since less than 0.5 percent of cases are open, duration is estimated rarely.[15] Nevertheless, we set the duration of cases still ongoing at 42 months equal to 42 months to eliminate any estimated durations. We restrict the sample to exclude claims with lump-sum payments since it is difficult to calculate a duration and a weekly benefit amount in these cases. Claims involving payments other than temporary total benefits and those for which previous earnings are unknown are also excluded.[16]

To make the before and after groups shown in Figure 1 as comparable as possible, the upper and lower limits (E_1 and E_2) on previous earnings for the low-earnings group and the lower earnings limit (E_3) for the high-earnings group are indexed using state-level average weekly earnings.[17] During the year surrounding the benefit increase in Kentucky, average earnings rose 8.94 percent. The analogous figure for Michigan is 7.76 percent.

Table 1 reports some summary measures of the change in benefit structure in Kentucky and Michigan. In both states, the fraction of previous earnings replaced by workers' compensation rises dramatically for the high-earnings group which received the benefit increase, but remains constant for low-earnings individuals who are unaffected by the increase. A very similar pattern is evident for the real benefit amount. The percentage rise for the high-earnings group in Michigan is not as high as the rise in the maximum benefit for the reasons given in Section I. Previous earnings and the fraction of claims filed by males are very similar before and after the benefit increases in both states and earnings groups. There are some changes in the composition of claims by industry, but they go in different directions for the two states. Since the empirical results are very similar when done separately for the three industry groups, the changes in composition did not bias the results discussed in Section III below. Moreover, the regression analysis in Section IV explicitly accounts for changes in the industry mix.

Table 2 reports the composition of the sample by injury type. The large injury categories are a fairly stable fraction of the total in Kentucky. Michigan is less stable, with a notable decline in injuries to upper extremities for high-earnings individuals. Again, the regression analysis below controls for injury type.

As the data in Table 3 indicate, the frequency of the different benefit types for high-earnings claims relative to low-earnings claims does change somewhat, but the changes are in opposite directions for the two states. In Kentucky there is a relative increase in the temporary total fraction of claims for high-earnings individuals, while in Michigan there is a relative increase for low-earnings individuals. A similarly mixed pattern is also evident in the frequency of lump-sum payments in the two states. There is no consistent pattern to the changes in claim composition. Furthermore, since both of these changes affect a very small percentage of the sample, they are unlikely to have appreciable effects on statistics like the

[15]By 42 months, more than 99.5 percent of claims are recorded as closed in Kentucky and Michigan. However, these numbers seem to conflict with the claims distribution, which indicates that 0.85 percent of the Kentucky claims and 3.15 percent of the Michigan claims are at least 42 months long.

[16]The frequency of other types of claims can be seen in Table 3. The frequency of claims with unknown previous earnings was 0.41 percent in Kentucky and 1.84 percent in Michigan.

[17]These numbers are used because they are at the state level, have broad coverage, and are available on a quarterly basis so they match the qualifying periods well. The average wage data are unpublished but were provided by Cindy Ambler of the U.S. Department of Labor. In Kentucky, the nominal values of E_1, E_2, and E_3 are \$66.00, \$196.50, and \$298.79, respectively, before the increase, and \$71.90, \$214.07, and \$325.50 after the increase. In Michigan, the values are \$216.00, \$271.50, and \$556.79 before the increase and \$232.76, \$292.57, and \$600.00 after the increase.

TABLE 1—REPLACEMENT RATES, EARNINGS, AND DEMOGRAPHIC CHARACTERISTICS DURING THE YEARS BEFORE AND AFTER BENEFIT INCREASES

Variable	Kentucky			Michigan		
	Before increase (1)	After increase (2)	Percentage change (3)	Before increase (4)	After increase (5)	Percentage change (6)
Maximum benefit ($)	131.00	217.00	65.65	181.00	307.00	69.61
Replacement rate, high earnings (percent)	32.70 (0.25)	51.02 (0.37)	56.02 (1.65)	30.01 (0.35)	44.15 (0.48)	47.14 (2.33)
Replacement rate, low earnings (percent)	66.42 (0.20)	66.66 (0.22)	0.36 (0.44)	66.64 (0.24)	66.35 (0.30)	−0.45 (0.58)
Average benefit (1983 $), high earnings	151.08 (0.96)	239.09 (1.32)	58.25 (1.33)	220.66 (1.78)	320.48 (2.27)	45.24 (1.56)
Average benefit (1983 $), low earnings	118.58 (0.64)	118.26 (0.74)	−0.27 (0.82)	183.66 (0.78)	182.77 (0.93)	−0.45 (0.58)
Average earnings (1983 $), high earnings	475.31 (2.45)	482.41 (2.73)	1.49 (0.78)	749.72 (7.25)	739.01 (7.49)	−1.43 (1.38)
Average earnings (1983 $), low earnings	179.09 (0.89)	177.54 (0.97)	−0.86 (0.73)	275.83 (0.75)	275.65 (0.83)	−0.07 (0.40)
Percentage male, high earnings	94.39 (0.66)	95.78 (0.59)	1.47 (0.94)	100.00 —	97.25 (1.11)	−2.75 —
Percentage male, low earnings	64.36 (1.16)	62.88 (1.24)	−2.30 (2.61)	73.94 (1.81)	75.58 (1.97)	2.22 (3.50)
Percentage manufacturing, high earnings	15.69 (1.04)	18.80 (1.15)	19.84 (10.79)	36.82 (3.12)	19.72 (2.70)	−46.43 (30.01)
Percentage manufacturing, low earnings	30.71 (1.12)	31.52 (1.19)	2.65 (5.38)	44.69 (2.06)	41.35 (2.26)	−7.48 (7.73)
Percentage construction, high earnings	20.65 (1.15)	16.55 (1.09)	−19.85 (6.94)	34.73 (3.08)	35.78 (3.25)	3.03 (12.31)
Percentage construction, low earnings	9.29 (0.70)	10.48 (0.78)	12.81 (12.01)	12.33 (1.36)	9.07 (1.32)	−26.42 (24.81)
Sample sizes:						
High earnings	1,233	1,161		239	219	
Low earnings	1,705	1,527		589	477	

Notes: Standard errors are in parentheses. The standard errors for the percentage male in the high-earnings group cannot be calculated in the usual way. Wages are in 1982 dollars, indexed using state level average weekly earnings from the Unemployment Insurance Service.

mean of the natural logarithm of duration which is examined below.

One should remember though, that the comparisons below will be valid as long as any changes in Kentucky and Michigan, other than the increase in the benefit maximum, affected the high- and low-earnings groups similarly. In most of the comparisons, we examine the durations and medical costs of low-earnings individuals before and after the benefit increases in case the changes we observe for high-earnings individuals were occurring for all groups.

III. Changes in the Distribution of Injury Durations

In this section we examine whether the length of receipt of workers' compensation rose after the benefit increases and whether there were comparable changes in the severity of the corresponding injuries.

TABLE 2—KENTUCKY AND MICHIGAN: INJURY TYPES (PERCENTAGES) DURING THE YEARS BEFORE AND AFTER BENEFIT INCREASES

	Kentucky			Michigan		
Injury type	Before increase (1)	After increase (2)	Percentage change (3)	Before increase (4)	After increase (5)	Percentage change (6)
Head, high earnings	4.38	3.36	−23.30	4.18	2.74	−34.52
	(0.58)	(0.53)	(15.81)	(1.30)	(1.10)	(33.25)
Head, low earnings	3.40	4.32	27.06	2.72	2.31	−15.11
	(0.44)	(0.52)	(22.43)	(0.67)	(0.69)	(32.84)
Neck, high earnings	2.27	3.19	40.34	2.51	1.37	−45.43
	(0.42)	(0.52)	(34.68)	(1.01)	(0.79)	(38.25)
Neck, low earnings	0.88	1.31	48.88	1.19	1.26	5.84
	(0.23)	(0.29)	(50.58)	(0.45)	(0.51)	(58.52)
Upper extremities, high earnings	23.76	23.51	−1.05	30.96	18.26	−41.01
	(1.21)	(1.24)	(7.27)	(2.99)	(2.61)	(10.18)
Upper extremities, low earnings	34.13	33.01	−3.31	33.11	31.45	−5.02
	(1.15)	(1.20)	(4.80)	(1.94)	(2.13)	(8.50)
Trunk, high earnings	12.41	12.23	−1.43	14.23	19.63	38.02
	(0.94)	(0.96)	(10.75)	(2.26)	(2.68)	(28.92)
Trunk, low earnings	10.26	9.36	−8.76	11.38	12.37	8.74
	(0.73)	(0.75)	(9.77)	(1.31)	(1.51)	(18.22)
Low back, high earnings	28.71	28.34	−1.30	21.34	26.03	21.97
	(1.29)	(1.32)	(6.39)	(2.65)	(2.97)	(20.56)
Low back, low earnings	24.69	26.20	6.09	25.64	22.85	−10.87
	(1.04)	(1.13)	(6.40)	(1.80)	(1.92)	(9.77)
Lower extremities, high earnings	24.98	24.12	−3.45	22.59	27.85	23.28
	(1.23)	(1.26)	(6.93)	(2.71)	(3.03)	(19.94)
Lower extremities, low earnings	22.99	21.87	−4.86	19.35	23.69	22.40
	(1.02)	(1.06)	(6.24)	(1.63)	(1.95)	(14.39)
Other injuries, high earnings	2.51	4.05	61.02	4.18	2.74	−34.52
	(0.45)	(0.58)	(36.67)	(1.30)	(1.10)	(33.25)
Other injuries, low earnings	3.05	3.01	−1.23	3.74	4.61	23.48
	(0.42)	(0.44)	(19.69)	(0.78)	(0.96)	(36.45)
Occupational diseases, high earnings	0.97	1.21	23.90	0.00	1.37	—
	(0.28)	(0.32)	(48.48)	—	(0.79)	—
Occupational diseases, low earnings	0.59	0.92	56.32	2.89	1.47	−49.16
	(0.18)	(0.24)	(64.49)	(0.69)	(0.55)	(22.62)
Sample sizes:						
High earnings	1,233	1,161		239	219	
Low earnings	1,705	1,527		589	477	

Notes: Standard errors are in parentheses. The standard errors for the percentage of occupational diseases in Michigan in the high-earnings group cannot be calculated in the usual way.

TABLE 3—FREQUENCY (PERCENTAGES) OF BENEFIT TYPES AND LUMP-SUM PAYMENTS, DURING THE YEARS BEFORE AND AFTER BENEFIT INCREASES

	Kentucky			Michigan		
Benefit type	Before increase (1)	After increase (2)	Percentage change (3)	Before increase (4)	After increase (5)	Percentage change (6)
Temporary total						
High earnings	83.63	87.13	4.19	88.26	88.69	0.49
	(0.93)	(0.89)	(1.57)	(1.87)	(1.91)	(3.03)
Low earnings	85.74	85.97	0.27	87.63	90.10	2.82
	(0.76)	(0.80)	(1.28)	(1.19)	(1.23)	(1.99)
Permanent partial						
High earnings	12.06	8.18	−32.17	0.67	0.73	8.76
	(0.81)	(0.72)	(7.55)	(0.47)	(0.51)	(108.38)
Low earnings	10.04	9.39	−6.47	1.05	1.54	45.90
	(0.65)	(0.67)	(9.02)	(0.37)	(0.51)	(70.44)
Other benefits						
High earnings	4.31	4.69	8.64	11.07	10.58	−4.42
	(0.51)	(0.56)	(18.21)	(1.82)	(1.86)	(22.97)
Low earnings	4.22	4.64	9.95	11.32	8.36	−26.11
	(0.44)	(0.48)	(16.11)	(1.15)	(1.14)	(12.59)
Sample sizes:						
High earnings	1,600	1,430		298	274	
Low earnings	2,132	1,896		760	586	
Temporary total, lump sums:						
High earnings	7.85	6.82	−13.07	9.13	9.88	8.23
	(0.74)	(0.71)	(12.21)	(1.78)	(1.91)	(29.72)
Low earnings	6.73	6.32	−6.09	11.56	9.66	−16.46
	(0.59)	(0.60)	(12.13)	(1.24)	(1.29)	(14.28)
Sample sizes:						
High earnings	1,338	1,246		263	243	
Low earnings	1,828	1,630		666	528	

Notes: Standard errors are in parentheses. The benefit types require some explanation: "other" includes combinations of benefit types, permanent total, temporary partial, and death.

Table 4 reports measures of the duration and the total medical costs of claims in Kentucky and Michigan for the year before and the year after the benefit increases. We report the mean, median, 75th percentile, and the mean of the natural logarithm of duration.[18] We emphasize the mean of the logarithm of duration because this statistic is likely to be more precisely measured and less susceptible to the influence of a few large observations. This issue of robustness is important here since the distribution of claim lengths has a few large values, but most values are small. The median in most groups is 5 weeks or less, but 2 percent of the observations are at least 182 weeks ($3\frac{1}{2}$ years). The mean of the untransformed data

[18]Approximately 5 percent of the durations are recorded as zero (see Table 5) because insurance companies are instructed to round duration to the nearest whole number of weeks. Since these durations lie in the interval (0.0, 0.5), we set their values to the midpoint of the interval (i.e., 0.25) before taking logarithms. With this recording, each observation is coded to the midpoint of its interval of true values. When we add 0.5 to all observations or exclude all zeros the results are very similar to those reported here.

TABLE 4—KENTUCKY AND MICHIGAN: DURATION AND MEDICAL COSTS OF TEMPORARY TOTAL DISABILITIES DURING THE YEARS BEFORE AND AFTER BENEFIT INCREASES

	High earnings		Low earnings		Differences		Difference in differences
Variable	Before increase (1)	After increase (2)	Before increase (3)	After increase (4)	[(2)−(1)] (5)	[(4)−(3)] (6)	[(5)−(6)] (7)
Mean duration (weeks)							
Kentucky	11.16	12.89	6.25	7.01	1.72	0.76	0.96
	(0.83)	(0.83)	(0.30)	(0.41)	(1.17)	(0.51)	(1.28)
Michigan	14.76	19.42	10.94	13.64	4.66	2.70	1.96
	(2.25)	(2.67)	(1.09)	(1.56)	(3.49)	(1.90)	(3.97)
Median duration (weeks)							
Kentucky	4.00	5.00	3.00	3.00	1.00	0.00	1.00
	(0.14)	(0.20)	(0.11)	(0.12)	(0.25)	(0.16)	(0.29)
Michigan	5.00	7.00	4.00	4.00	2.00	0.00	2.00
	(0.45)	(0.67)	(0.22)	(0.28)	(0.81)	(0.35)	(0.89)
75th percentile, duration (weeks)							
Kentucky	8.00	10.00	7.00	7.00	2.00	0.00	2.00
	(0.28)	(0.45)	(0.21)	(0.24)	(0.53)	(0.32)	(0.62)
Michigan	10.00	14.00	8.50	9.00	4.00	0.50	3.50
	(0.74)	(1.88)	(0.54)	(0.57)	(2.03)	(0.79)	(2.17)
Mean of log duration							
Kentucky	1.38	1.58	1.13	1.13	0.20	0.01	0.19
	(0.04)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.07)
Michigan	1.58	1.87	1.41	1.51	0.29	0.10	0.19
	(0.09)	(0.10)	(0.06)	(0.06)	(0.13)	(0.08)	(0.16)
Mean medical cost (dollars)							
Kentucky	3,298.96	1,688.67	878.20	1,155.98	−1,610.29	277.78	−1,888.07
	(1,885.93)	(116.59)	(78.07)	(157.26)	(1,889.53)	(175.57)	(1,897.67)
Michigan	2,229.41	2,585.23	1,538.22	2,017.65	355.82	479.43	−123.61
	(293.93)	(364.76)	(188.49)	(304.83)	(468.45)	(358.40)	(589.83)
Median medical cost (dollars)							
Kentucky	393.51	411.49	238.96	254.40	17.98	15.44	2.55
	(19.29)	(22.72)	(8.48)	(9.11)	(29.80)	(12.44)	(32.30)
Michigan	689.73	765.00	390.63	435.00	75.27	44.38	30.89
	(77.30)	(134.53)	(32.80)	(33.09)	(155.16)	(46.59)	(162.00)
75th percentile, cost (dollars)							
Kentucky	1,335.71	1,686.40	864.94	867.53	350.69	2.59	348.10
	(103.08)	(122.95)	(72.24)	(69.78)	(160.45)	(100.44)	(189.29)
Michigan	2,284.60	2,379.00	1,383.93	1,822.00	94.40	438.07	−343.67
	(178.51)	(284.80)	(155.69)	(145.49)	(336.12)	(213.09)	(397.98)
Mean of log cost							
Kentucky	6.09	6.24	5.61	5.69	0.15	0.08	0.07
	(0.05)	(0.05)	(0.04)	(0.04)	(0.07)	(0.06)	(0.09)
Michigan	6.56	6.59	5.85	6.10	0.03	0.25	−0.22
	(0.11)	(0.13)	(0.09)	(0.09)	(0.17)	(0.12)	(0.21)
Sample size:							
Kentucky	1,233	1,161	1,705	1,527			
Michigan	239	219	589	477			

Notes: Standard errors are in parentheses. Medical costs are in 1982 dollars, indexed using the medical-care component of the CPI. The standard errors of the median and 75th percentile are calculated using the formula reported in Bickel and Doksum (1977 p. 400). The density functions of the duration and medical-cost distributions are estimated using a histogram with intervals of 3 weeks and 5 weeks around the median and 75th percentile of duration, respectively, and $200 and $400 around the median and 75th percentile of costs, respectively.

is susceptible to large changes due to a few observations.[19]

Column 5 of the upper panel of Table 4 reports the change in duration for high-earnings individuals after the increase, as indicated by each of the summary statistics for the two states. There are large increases in the mean duration in both states, but the standard errors are almost as large as the changes. The imprecision of the mean is not surprising in this data set given the skewness of the data. Similar increases occur in the median and 75th percentile of the duration distribution. While the standard errors on these percentiles suggest that these changes are significant, the standard errors are only approximate, as they assume a continuous distribution while the duration distribution is discrete and coarse.[20] The mean of the logarithm avoids the problems of the mean and percentiles: it has fairly small standard errors that can be estimated well. There are large and statistically significant increases in the logarithm of duration of temporary total claims after the benefit increases for the high-earnings group in both states. In Kentucky, mean durations rise by 20 percent and in Michigan by 29 percent. Both of these increases are significant at the 0.05 percent level.

In case there were events common to both high- and low-earnings groups we report changes over the same period for the low-earnings group in column 6, which was not subject to the benefit increases. The point estimates for the mean of duration indicate increases about half as large as those for high-earnings claims, but again the estimates are very imprecise. The mean of the logarithm, median, and 75th percentile indicate that the low-earnings group did not experience any significant change in duration. All of the statistics in both states indicate that there was only the slightest change, if any, for the low-earnings group, except for a moderate 10-percent change in the logarithm of duration in Michigan that is statistically insignificant.

Difference-in-difference estimates, while less precise, can be used to remove any bias due to changes over time in factors that are common to the high- and low-earnings groups. Column 7 reports the change in duration for high-earnings individuals minus the comparable change for low-earnings individuals. These numbers indicate a large and significant relative increase in the logarithm of duration for the high-earnings group in Kentucky, with a similar magnitude but insignificant increase in Michigan. There are moderate increases for both states in the untransformed mean, but they are imprecisely measured. The median and 75th percentile indicate changes slightly larger than those for the logarithm of duration, but the standard errors should be interpreted with caution, as indicated earlier.

These changes in duration do not appear to be the result of changes in the severity of injuries. The comparability of the claims from the year before the increases to those the year after the benefit increases is generally supported by the numbers on total medical costs associated with the claims. These numbers, reported in the second panel of Table 4, show that the high- and low-earnings groups experience similar increases in median costs, probably due to a general rise in medical costs.[21] The mean of the logarithm[22] and the 75th percentile of total medical cost show a relative increase in costs for the high-earnings group in Kentucky, but a relative decrease in Michigan. The mean of costs in Kentucky shows a relative decrease in severity for the high-earnings group. We should emphasize, though, that none of the difference-in-difference estimates is significantly different from zero. Overall, while the duration of

[19] For an excellent introduction to robustness and the sensitivity of the mean see Peter J. Bickel and Kjell Doksum (1977 pp. 369–78). Also see Takeshi Amemiya (1985 pp. 70–9).

[20] The standard errors of the median and 75th percentile are calculated using the formula reported in Bickel and Doksum (1977 p. 400).

[21] While the medical-cost figures are indexed using the medical-care component of the Consumer Price Index, there may be local variation in medical-cost inflation for which we do not adequately control.

[22] Before taking logarithms, we set all total medical expenses less than $1 equal to $1.

claims subject to the benefit increases rose substantially, their average severity as indicated by the medical-cost statistics in Table 4 does not rise.[23]

The elasticity of the duration of claims with respect to the temporary total benefit can be calculated by dividing the change in duration by the percentage change in the replacement rate for high-earnings claimants reported in Table 1. Using the estimates for the change in the mean of the logarithm of duration in column 5 of Table 4, the implied elasticities are 0.36 for Kentucky and 0.62 for Michigan. The difference-in-differences estimates of column 7 imply elasticities of 0.34 and 0.40 for the two states.[24] These estimates suggest large benefit effects on the length of time people take to return to work after being injured.

Results from Alternative Methods and Samples

Table 5 reports the change in the entire distribution of claim lengths after the benefit increases for both the high-earnings and low-earnings groups. The numbers indicate large and significant changes through most of the cumulative distribution for the high-earnings individuals in both states. There is little change for the low-earnings groups, though some of the small changes are significant at conventional levels.[25] Figures 2 and 3 graphically display the distribution of claim durations for the high-earnings individuals before and after the benefit increases. Figure 2 is the cumulative distribution of claim durations in Kentucky, while Figure 3 is the distribution in Michigan. Both states show an increase in all percentiles of the injury distribution. We perform Wilcoxon two-sample rank tests to test nonparametrically whether the injury duration distributions are different after the benefit increases. For high-earnings individuals, the test statistics have the significant P values of 0.0004 in Kentucky and 0.0240 in Michigan. The corresponding statistics for the low-earnings groups are 0.9373 and 0.6170. Thus, nonparametric comparisons of the distribution of spell lengths show evidence of changes in the distribution for high-earnings individuals, but no change for low-earnings individuals.

The changes in duration reported in Table 4 are nearly identical when we exclude individuals with injury dates between two weeks before and two weeks after the increases. We checked this slightly different sample of claims in case there was some ability to delay reporting injuries to receive a higher weekly benefit. The ability to delay reporting might be possible in the case of some cumulative injuries.

A possible confounding factor in any analysis of the effects of benefits is that higher benefits might induce changes in the composition of the population examined. If higher benefits lead more people to make indemnity claims, then our estimates are likely to understate the effects of higher benefits on claim durations. The additional people who file claims when benefits rise are likely to have suffered minor injuries with short durations, since they had not planned to submit a claim previously. On the other hand, the structure of benefits might affect transitions from temporary total to permanent disability as suggested by Terry Thomason (1993) and John D. Worrall et al. (1993). The direction in which our results would be biased by such an effect is not clear, as we exclude permanent disabilities from the sample we analyze. Since this effect is likely to apply to a small number of claims relative to the total number of permanent partial claims, there is

[23] If there is any bias in the comparisons of medical costs, it would likely go in the direction of finding increases in medical costs for the high-earnings group if a longer duration mechanically means more doctor visits independent of severity. It is possible (but unlikely), however, that greater medical costs might mean better rehabilitation and thus a speedier return to work. The regression estimates reported here suggest that this effect is not the dominant one.

[24] The standard errors for these four elasticity estimates are, in order, 0.09, 0.28, 0.12, and 0.34.

[25] While coarse discrete data make it problematic to estimate standard errors of quantiles, the standard errors of points on the cumulative distribution function are easily estimated.

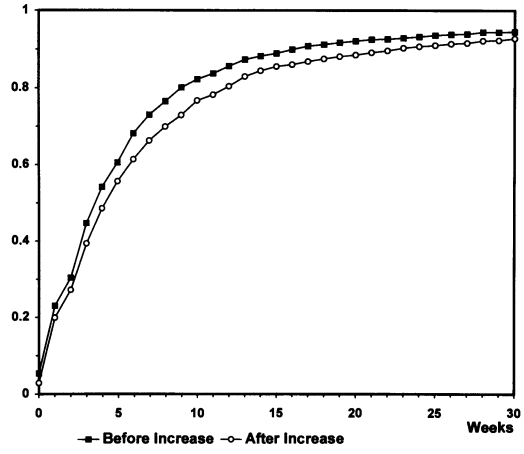

FIGURE 2. KENTUCKY CUMULATIVE DISTRIBUTION OF INJURY DURATION FOR HIGH-EARNINGS INDIVIDUALS, BEFORE AND AFTER BENEFIT INCREASE

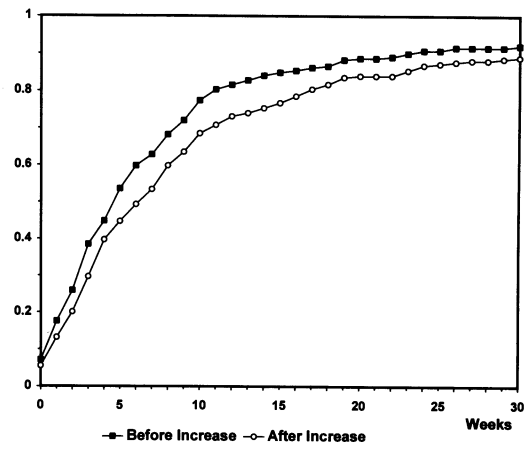

FIGURE 3. MICHIGAN CUMULATIVE DISTRIBUTION OF INJURY DURATION FOR HIGH-EARNINGS INDIVIDUALS, BEFORE AND AFTER BENEFIT INCREASE

TABLE 5—CUMULATIVE DISTRIBUTION FUNCTIONS OF CLAIM DURATION, DURING THE YEAR AFTER BENEFIT INCREASES, AND THE DIFFERENCE FROM THE YEAR BEFORE

	Kentucky						Michigan					
	High earnings			Low earnings			High earnings			Low earnings		
Week	After increase (1)	After − before (2)	Standard error (3)	After increase (4)	After − before (5)	Standard error (6)	After increase (7)	After − before (8)	Standard error (9)	After increase (10)	After − before (11)	Standard error (12)
0	0.029	−0.025	(0.0065)	0.100	0.006	(0.0071)	0.055	−0.016	(0.0167)	0.055	−0.032	(0.0117)
1	0.199	−0.031	(0.0121)	0.270	0.003	(0.0108)	0.132	−0.044	(0.0248)	0.172	−0.011	(0.0160)
2	0.272	−0.032	(0.0132)	0.363	0.002	(0.0117)	0.201	−0.058	(0.0285)	0.317	0.020	(0.0190)
3	0.394	−0.053	(0.0143)	0.514	0.011	(0.0122)	0.297	−0.088	(0.0317)	0.440	0.010	(0.0206)
4	0.486	−0.056	(0.0143)	0.599	0.001	(0.0120)	0.397	−0.051	(0.0324)	0.514	0.011	(0.0209)
5	0.557	−0.049	(0.0141)	0.674	0.011	(0.0116)	0.447	−0.089	(0.0326)	0.566	−0.008	(0.0207)
6	0.614	−0.068	(0.0135)	0.727	−0.001	(0.0110)	0.493	−0.105	(0.0321)	0.625	−0.013	(0.0201)
7	0.663	−0.067	(0.0129)	0.767	−0.003	(0.0104)	0.534	−0.094	(0.0317)	0.658	−0.036	(0.0193)
8	0.699	−0.066	(0.0123)	0.805	−0.008	(0.0097)	0.598	−0.084	(0.0306)	0.723	−0.027	(0.0183)
9	0.729	−0.072	(0.0116)	0.832	−0.014	(0.0090)	0.635	−0.085	(0.0295)	0.757	−0.026	(0.0174)
10	0.767	−0.055	(0.0112)	0.851	−0.022	(0.0084)	0.685	−0.089	(0.0276)	0.780	−0.023	(0.0169)
11	0.782	−0.055	(0.0108)	0.870	−0.022	(0.0079)	0.708	−0.095	(0.0263)	0.799	−0.021	(0.0163)
12	0.804	−0.052	(0.0103)	0.881	−0.020	(0.0076)	0.731	−0.085	(0.0257)	0.820	−0.026	(0.0154)
13	0.829	−0.044	(0.0098)	0.898	−0.013	(0.0073)	0.740	−0.088	(0.0251)	0.832	−0.025	(0.0150)
14	0.844	−0.038	(0.0096)	0.905	−0.018	(0.0069)	0.753	−0.088	(0.0244)	0.847	−0.024	(0.0144)
15	0.855	−0.034	(0.0093)	0.919	−0.012	(0.0066)	0.767	−0.082	(0.0239)	0.855	−0.028	(0.0139)
16	0.860	−0.039	(0.0090)	0.927	−0.011	(0.0063)	0.785	−0.069	(0.0236)	0.864	−0.026	(0.0136)
17	0.868	−0.040	(0.0087)	0.933	−0.011	(0.0061)	0.804	−0.058	(0.0231)	0.876	−0.024	(0.0131)
18	0.875	−0.037	(0.0085)	0.940	−0.009	(0.0059)	0.817	−0.049	(0.0229)	0.889	−0.021	(0.0126)
19	0.881	−0.036	(0.0083)	0.945	−0.007	(0.0057)	0.836	−0.047	(0.0217)	0.893	−0.020	(0.0124)
20	0.885	−0.036	(0.0082)	0.948	−0.007	(0.0056)	0.840	−0.047	(0.0214)	0.899	−0.016	(0.0123)
21	0.891	−0.034	(0.0080)	0.952	−0.009	(0.0053)	0.840	−0.047	(0.0214)	0.904	−0.013	(0.0122)
22	0.896	−0.030	(0.0080)	0.957	−0.007	(0.0052)	0.840	−0.051	(0.0211)	0.910	−0.012	(0.0119)
23	0.903	−0.026	(0.0078)	0.960	−0.008	(0.0049)	0.854	−0.046	(0.0204)	0.914	−0.008	(0.0119)
24	0.907	−0.025	(0.0077)	0.963	−0.007	(0.0048)	0.868	−0.040	(0.0197)	0.920	−0.007	(0.0116)
25	0.910	−0.026	(0.0075)	0.966	−0.004	(0.0048)	0.872	−0.036	(0.0197)	0.922	−0.007	(0.0115)
26	0.914	−0.024	(0.0074)	0.967	−0.006	(0.0047)	0.877	−0.039	(0.0190)	0.922	−0.008	(0.0114)
27	0.916	−0.023	(0.0074)	0.968	−0.009	(0.0044)	0.881	−0.035	(0.0190)	0.925	−0.009	(0.0111)
28	0.922	−0.022	(0.0071)	0.969	−0.008	(0.0044)	0.881	−0.035	(0.0190)	0.927	−0.010	(0.0109)
29	0.923	−0.021	(0.0071)	0.971	−0.009	(0.0042)	0.886	−0.030	(0.0190)	0.929	−0.012	(0.0107)
30	0.928	−0.017	(0.0071)	0.971	−0.011	(0.0041)	0.890	−0.031	(0.0186)	0.937	−0.004	(0.0107)

unlikely to be an appreciable effect on the mean of the natural logarithm emphasized above. While a few large observations can greatly affect a mean, they will likely have less of an effect on the mean of the natural logarithm or the median. One should also note that there is very little evidence of an increase in the severity of the claims as measured by medical costs. Therefore, we think that any effects of changes in the composition of the population examined are likely to be small. In addition, we can adjust for the effects of changes in observable characteristics of claimants. We turn to this issue in the next section.

IV. Regression Estimates of the Changes in Duration

To account for possible changes in the composition of the sample after the benefit increases, we estimate a series of regression equations that control for all of the available characteristics of the worker, the job, and the injury. Specifically, the estimates in Table 6 control for worker age, marital status, sex, industry, and the severity of the injury as measured by medical costs, hospital days, and type of injury. The specifications that we try are the regression analogue of the differences and difference in differences of Table 4. In all of the equations, the dependent variable is the natural logarithm of duration, measured in weeks. In the absence of censoring and time-varying explanatory variables, the commonly used exponential, Weibull, and log-logistic hazard models with and without unobserved heterogeneity are special cases of log-duration regression. These listed hazard models assume particular distributions for the error term which log-duration regression allows us to leave unspecified. The sample sizes are slightly smaller than those earlier because of missing variables. In almost all cases the missing variable is marital status.

Two sets of specifications are estimated: specifications (i)–(iv), which pool high- and low-earnings individuals, and specifications (v)–(viii) with only high-earnings workers. Variables in the pooled estimates explicitly take into account two possibly confounding determinants of spell lengths in the sample. An indicator variable for whether the observation is after the benefit increase ("after-increase" variable) removes any effect of being after the increase that is common to both the high-earnings and low-earnings groups. The high-earnings variable and the ln(previous earnings) × high-earnings-group interaction variable net out any time-invariant differences between the high-earnings and low-earnings groups. The key variable to interpret in these pooled estimates is the third variable appearing in Table 6—the interaction between an observation's being after the increase and in the high-earnings group. This dummy variable is an indicator for the group which experienced the increase in benefits, and it measures the percentage change in duration associated with the benefit increase. The coefficient has the expected positive sign in both states and is significant at conventional levels in Kentucky.

It is important to note that these estimates are quite similar in size and significance to the difference of the differences in mean log duration reported in Table 4. The similarity is not surprising since the after-increase × high-earnings-group coefficient is the regression analogue of the difference in column 5 minus the difference in column 6 in that table. If only a constant and the first three dummy variables are included, the regression should reproduce this difference of differences.[26]

For the second set of estimates, reported in columns (v)–(viii) of Table 6, we use only the high-earnings observations. These estimates correspond to the difference in the mean of the logarithm of duration as re-

[26]The standard error will only be the same if one allows the four groups to have different error variances. There will be some slight differences since our regressions assume homoscedasticity and use a slightly smaller sample because of missing values of some variables. For the key coefficient, the estimate (standard error) from the regression with only dummy variables is 0.23 (0.07) for Kentucky and 0.20 (0.16) for Michigan.

TABLE 6—REGRESSION EQUATIONS FOR NATURAL LOGARITHM OF DURATION, HIGH- AND LOW-EARNINGS GROUPS POOLED, AND HIGH-EARNINGS GROUP SEPARATELY

	Specification							
	High- and low-earnings groups pooled				High-earnings group only			
	Kentucky		Michigan		Kentucky		Michigan	
Explanatory variable	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
After-increase indicator variable	0.016	−0.004	0.082	0.003	0.228	0.149	0.244	0.260
	(0.045)	(0.038)	(0.084)	(0.073)	(0.054)	(0.044)	(0.136)	(0.113)
High-earnings-group indicator variable	−1.522	−0.594	5.577	3.607				
	(1.099)	(0.930)	(4.811)	(4.162)				
After-increase × high-earnings-group indicator variable	0.215	0.162	0.157	0.203				
	(0.069)	(0.059)	(0.153)	(0.132)				
ln(Previous earnings)	0.258	0.207	0.901	0.139	0.492	0.229	0.067	−0.335
	(0.104)	(0.088)	(0.648)	(0.562)	(0.163)	(0.133)	(0.496)	(0.414)
ln(Previous earnings) × high-earnings group	0.232	0.065	−0.973	−0.587				
	(0.187)	(0.158)	(0.803)	(0.695)				
Male indicator variable	−0.072	−0.070	−0.303	−0.332	−0.088	0.004	−1.053	−0.489
	(0.046)	(0.039)	(0.099)	(0.086)	(0.133)	(0.108)	(0.631)	(0.527)
Married indicator variable	0.051	0.055	−0.024	−0.065	0.179	0.112	−0.097	−0.287
	(0.041)	(0.035)	(0.081)	(0.070)	(0.080)	(0.065)	(0.185)	(0.154)
ln(Age)	0.252	0.244	0.464	0.481	0.071	0.056	0.796	0.850
	(0.052)	(0.044)	(0.114)	(0.098)	(0.092)	(0.075)	(0.234)	(0.195)
ln(Total medical costs)		0.361		0.316		0.421		0.475
		(0.011)		(0.018)		(0.018)		(0.037)
Hospital-stay indicator variable		0.252		0.243		0.191		−0.279
		(0.044)		(0.084)		(0.065)		(0.148)
Industry indicators:								
Manufacturing	−0.173	−0.153	−0.080	−0.126	−0.198	−0.200	−0.055	0.008
	(0.042)	(0.035)	(0.078)	(0.068)	(0.075)	(0.061)	(0.168)	(0.141)
Construction	0.076	0.044	0.448	0.348	0.042	0.035	0.618	0.466
	(0.052)	(0.044)	(0.101)	(0.088)	(0.071)	(0.058)	(0.156)	(0.131)
Injury type indicators:								
Head	−0.511	−0.432	−0.734	−0.833	−0.459	−0.335	−1.893	−1.122
	(0.129)	(0.109)	(0.271)	(0.235)	(0.200)	(0.163)	(0.487)	(0.410)
Neck	0.269	0.358	−0.215	−0.283	0.333	0.479	−0.874	−0.560
	(0.161)	(0.137)	(0.342)	(0.296)	(0.221)	(0.180)	(0.572)	(0.477)
Upper extremities	−0.163	0.132	−0.179	−0.223	−0.305	0.139	−0.712	−0.161
	(0.101)	(0.086)	(0.189)	(0.163)	(0.157)	(0.129)	(0.366)	(0.308)
Trunk	0.123	0.143	0.087	−0.135	0.064	0.155	−0.488	−0.153
	(0.109)	(0.092)	(0.202)	(0.176)	(0.165)	(0.135)	(0.379)	(0.317)
Low back	−0.010	0.185	−0.404	−0.341	−0.082	0.259	−0.848	−0.315
	(0.101)	(0.086)	(0.191)	(0.165)	(0.156)	(0.127)	(0.368)	(0.310)
Lower extremities	−0.116	0.184	−0.317	−0.309	−0.138	0.264	−0.861	−0.393
	(0.102)	(0.087)	(0.192)	(0.166)	(0.157)	(0.128)	(0.366)	(0.307)
Occupational diseases	0.278	0.526	0.387	0.353	0.497	0.759	−2.575	−2.138
	(0.210)	(0.178)	(0.327)	(0.283)	(0.297)	(0.242)	(1.034)	(0.867)
Sample size:	5,347	5,347	1,475	1,475	2,231	2,231	447	447
R^2:	0.049	0.319	0.069	0.304	0.039	0.363	0.131	0.400

Notes: The dependent variable is ln(duration). A constant is included in each equation. Standard errors are in parentheses. The omitted industry is "other industries," and the omitted injury is "other injuries." The sample sizes are slightly smaller than those in the earlier tables because of missing data for marital status. Previous wage and medical costs are in 1982 dollars.

ported in column 6 of Table 4.[27] Since the after-increase coefficient is small and insignificant in the first four equations, especially when we control for a hospital stay and medical costs, it does not appear to be necessary to control for any effect of just being injured one year later. The ability to compare directly the high-earnings groups before and after the increase is also supported by the earlier comparisons of means, which show little change in low-earnings durations, especially in Kentucky. The key coefficient in these high-earnings-only equations is that of the after-increase variable. Since these regressions with only high-earnings individuals correspond to a single difference, the standard errors are smaller than those for the key variable in the first four equations. Again, these estimates are very close to the analogous differences in means of log duration reported in Table 4. Both the Kentucky and Michigan coefficients are significant at conventional levels, and they suggest large increases in duration after the benefit increases.

In all four pairs of estimates, the coefficients capturing the benefit increases are remarkably similar in the two states, and one cannot reject that they are equal at the 0.05 level. Medical costs, the hospital-stay indicator variable, and age are also particularly important variables in these equations. We have reported estimates with and without these variables because they are our best measures of injury severity, but they are potentially endogenous. Higher medical costs, a hospital stay, and being older all lead to a longer time until an injured worker returns to work. There is also some evidence that women have longer injury durations. The estimates of the key coefficient are quite similar when an indicator for the presence of an attorney and the interaction of marital status and male are added to the equations. Overall, the regression estimates are strikingly similar to the earlier comparisons of means, and the results support the conclusion that the earlier results are not due to changes in sample composition. The range of the point estimates of the duration elasticities from the regressions is 0.29–0.41 for Kentucky and 0.33–0.55 for Michigan.[28]

Results from Alternative Methods and Samples

We have tried several other sets of regression specifications that are not reported here.[29] Quantile regression estimates were estimated for the 0.1, 0.25, 0.5, 0.75, and 0.9 quantiles. Quantile regression reduces the importance of outliers and functional-form assumptions and allows us to examine features of a distribution besides the mean.[30] The estimates are the analogues of the median and 75th-percentile estimates earlier, but now we control for all of the individual and injury characteristics of Table 6. The estimates using the pooled sample (the analogue of differences in differences) show generally significant effects of the benefit increases on the central quantiles (0.25, 0.5, 0.75) of duration for both states, while insignificant but positive effects for the extreme quantiles (0.1 and 0.9). The main difference between the quantile estimates and the log-duration estimates is a higher

[27]The estimate (standard error) from the regression with only a constant and a dummy variable for being after the increase is 0.24 (0.05) for Kentucky and 0.27 (0.14) for Michigan.

[28]The standard errors of these elasticity estimates are, in order, 0.11, 0.10, 0.32, and 0.24. The elasticities are always calculated by dividing the regression coefficient for a state by the percentage change in the replacement rate for the high-earnings group in that state reported in the second line of Table 1. Following a referee's suggestion, we recalculated the elasticities by using as the denominator the percentage change in benefits calculated after regressing benefits on the control variables of Table 6. This procedure never changed the elasticities by more than 0.02.

[29]The tables on which these comments are based are available from the authors upon request.

[30]The seminal paper is Roger Koenker and Gilbert Bassett, Jr. (1978). See Gary Chamberlain (1991) and Moshe Buchinsky (1994) for good discussions of quantile regression and its use in applications.

degree of significance for the Michigan estimates under quantile regression.

We also tried an alternative sample of claims which includes the large number of individuals who receive higher benefits under the new workers' compensation laws but less than the maximum (those with previous earnings between E_2 and E_3 in Fig. 1). In Michigan, this group is over seven times as large as the high-earnings group, and in Kentucky it is slightly larger than the high-earnings group. These observations are used to provide much more precise estimates of the elasticity of injury duration with respect to the benefit amount. The cost of this approach is that we assume a linear relationship between the amount of the benefit increase and the change in duration. Estimates with the same individual control variables as in Table 6 are reported in Meyer et al. (1992) and indicate similar elasticity estimates to those reported above, but with a much higher degree of significance, especially in Michigan.

V. Conclusions

The results of this study suggest a substantial effect of the level of temporary total benefits on the duration of workers' compensation claims. The Kentucky estimates are generally significantly different from zero, while the Michigan estimates are similar in magnitude to the Kentucky estimates but are less precisely measured and generally not significantly different from zero. The elasticities range from 0.27 to 0.62, with most clustering between 0.3 and 0.4. Overall, the elasticity estimates are very similar in the two states. These results suggest substantial labor-supply effects of workers' compensation benefits. Our elasticity estimates tend to be toward the high end of those found in work which does not rely on a natural-experiment approach such as Richard J. Butler and Worrall (1985, 1993) and Worrall et al. (1988). These authors examined low-back injuries in Illinois and found elasticities between 0.2 and 0.4, depending on the statistical technique used. When they examined data pooled from 13 states, however, they did not find a consistent relationship between the level of benefits and the length of spells.

On the other hand, subsequent papers which have followed our approach and examined the effects of benefit increases tend to find larger duration elasticities. Krueger (1990b) examines a period nine months before and three months after a 5-percent increase in the benefit minimum and maximum in Minnesota and finds elasticities of over 1.5. John A. Gardner (1991) examines a three-year period before and after a 50-percent increase in Connecticut and finds an elasticity of nearly 1. William P. Curington (1994) examines four increases in benefits over a 14-year period in New York state. He focuses on permanent partial claims and finds elasticities near 1 for severe impairments, but much lower estimates for minor impairments.

We should caution the reader that the longer durations that we find after benefit increases may not indicate a loss in social welfare, as longer recovery times may improve subsequent health. Higher benefits may enable injured workers to complete their recovery before returning to work. To examine this question, we would like to be able to examine health status after an individual returns to work. Unfortunately, such an analysis is not possible with available data.

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