

Lost Injury Days: Moral Hazard Differences Between Tort and Workers' Compensation

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ABSTRACT

Texas is one of only three states where employers can opt out of workers' compensation, and the only state where a substantial number of employers choose to do so (44 percent). This article compares the lost injury day patterns of firms opting out of workers' compensation with those choosing to maintain a workers' compensation program. Support is found for the hypothesis that differences in reported lost work days partially reflect differences in moral hazard reporting incentives: in the opt-out sector, there are slightly higher injury rates, shorter lost work day durations, and fewer sprains and strains reported than in the workers' compensation sector.

INTRODUCTION

One of perennial topics concerning workplace safety in the United States is whether a tort (fault-based) system or a workers' compensation (no-fault) system is best for injury compensation. Although both systems exist in the United States on large scales—in the form of the Federal Employee Liability Act (FELA) for railroad employees (a tort system) and workers' compensation for virtually all nonrailroad employees—the difference in the industrial settings between FELA and workers' compensation is sufficient to make comparisons difficult at best.¹

Since Texas is one of only three states (the others are New Jersey and South Carolina) where firms can opt out of the workers' compensation system, and the

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¹ For an extensive discussion of the difficulty of comparing the FELA and workers' compensation systems, see Transportation Research Board (1994). The author was part of the committee that put together this report and has drawn freely from some of the ideas contained in it.

only state where a substantial number of employers have chosen to do so, it provides an interesting benchmark by which to compare a tort system with a workers' compensation system. But since opting out is a voluntary act, and firms and workers respond to the different incentives inherent in the workers' compensation and tort systems, the comparison between the two systems in Texas is not a "controlled experiment" for at least three reasons: First, optimal risk management practices are likely to change in the presence of the tort exposure. Second, firms are not randomly sorted into the "opt-out" sector, but tend to self-select themselves on the basis of their comparative advantage, and it is unclear a priori whether that "comparative advantage" leads safer or less safe firms to opt out. Third, it is important to distinguish real safety differences from reported differences (induced by insurance coverage) whenever possible.

Because opting out is voluntary in Texas, a comparison of workers' compensation firms with opt-out ("tort") firms must consider the different incentives offered by the two sectors. These incentives are discussed at greater length in the next section. I argue below that there may be offsetting sample selection and experience rating effects making it theoretically ambiguous whether opt-out firms are intrinsically more or less safe than those remaining in workers' compensation. My approach is to benchmark the level of real safety by comparing fatality rates between the two sectors (in the next section). Given this safety benchmark, I then discuss the institutional features of the Texas market in order to highlight differences in injury reporting incentives in the section that follows. I present evidence consistent with these reporting incentives in the last three sections of the article.

TORT VS. WORKERS' COMPENSATION

The optimal mix of risk management techniques—risk avoidance, loss prevention, loss reduction, and risk transfer—changes with the potential exposure to tort claims. Firms that opt out of workers' compensation are able to direct their workers to the employers' occupational medical centers, rather than let workers choose their own treating physicians. Many firms that I spoke with saw this as one of the significant benefits from opting out of workers' compensation. Also, most employees working in opt-out firms are covered by workplace injury agreements that often replicate workers' compensation-like medical and indemnity coverage.² This reduces the likelihood of a worker filing a suit and the likelihood of winning a suit should it be filed (because damages would tend to be limited to pain and suffering and the proportion of wages not replaced by the employer's injury agreement). Finally, many (larger) firms in Texas instigated significant safety plans when they opted out in order to further avoid the risk of injuries.³

² This is discussed more fully below. Detailed analyses of these issues can be found in two studies commissioned by the Texas Workers' Compensation Research Center (Dyer et al., 1993, 1994).

³ Schwartz (1994, pp. 391–392) reports a similar finding in the railroad sector, where employees may bring tort actions against railroad companies. In particular, as the number of FELA court claims

Tort actions may not be filed for other reasons as well. For financial reasons, lawyers may choose not to represent employees of small firms that have relatively few assets. The managers of these firms realize this and may opt out to avoid providing any workplace injury benefits with relatively little fear of being sued when there is an injury (many in Texas feel that small independent contractors often fall into this group).

Reported average injury data for firms in the workers' compensation and opt-out sectors will be affected both by prior self-selection into their respective sectors and by employers' and employees' incentives to report claims in those sectors. With the type of data (individual injury reports) available to this analysis, it is extremely difficult to differentiate the impact of sample selection on reported injury rates from the potential effect of experience rating on those injury rates. For example, if a small manufacturing company that had opted out of workers' compensation were observed to have lower injury rates than similarly situated manufacturing companies who remained in the workers' compensation system, would the difference be due to the "increased degree of experience rating" of the opt-out firm in the tort sector, or did that firm opt out because it was intrinsically safer than the other firms in its sector and did not want to have its insurance priced on the same basis as those firms?

Although it is difficult to determine whether real safety differences between the workers' compensation and tort sectors is due to sample selection or to experience rating, this study uses fatal injury rates as a benchmark for the real level of safety and looks at the differences in reported injury rates relative to that benchmark. In particular, this article examines whether the reported deviations from the benchmark are consistent with moral hazard "reporting" responses, given the type of risk management arrangements that are in place in the opt-out sector and given the intrinsic level of real safety as reflected in the fatal injury rates.

In the ideal marketplace with complete information and low transactions costs, injury rates will be the same for a given employer regardless of whether the employer chooses to opt out of workers' compensation.⁴ But injury rates and injury costs will differ if there are informational asymmetries between the various participants in the system (i.e., the worker or health care provider have better information on the true nature of the injury than the firm or the insurer). A no-fault system such as workers' compensation provides compensation regardless of who might have been negligent. This is a strict liability standard by which the employer is liable regardless of whether the employer is at fault for the employee's injury. With the negligence approach, on the other hand, only injuries that are due to the negligent actions of the employer allow recovery of damages. Workers who are injured in situations where employers are not negligent are not compensated.

rose for hearing impairments (the primary occupational illness for railroad workers), the railroads implemented a variety of hearing protection programs.

⁴ This is the Coase theorem result that says, regardless of the distribution of property rights, resources will be put to their most efficient (highest valued) use if there are no transaction costs and perfect information.

Under the strict liability standard, employers should have the same incentives to adopt safety precautions as under the negligence standard in a world with complete information. Since employers are liable for all accident costs, they have incentives to minimize their expected accident costs by adopting all those precautions whose safety benefits exceed their safety costs, the same rule that they would employ under a negligence standard. The difference between the two standards is that the employee gets compensated for the injury regardless of fault in the strict liability system but may not be compensated under the negligence standard.⁵

Workers' compensation, in Texas or elsewhere, is not a "pure" strict liability system in the sense that the firm's liability is limited by a dollar threshold established by the indemnity benefit structure. All medical costs are paid, but usually only a fraction of the actual wages lost due to the injury are paid, and there are no payments for pain and suffering under workers' compensation. This may modify the arguments made above.⁶ Under workers' compensation, both the employee and the employer bear some of the costs of the injury.

If there are no monitoring or transactions costs, then the accident rate, accident severity, and distribution of accident types should be the same under either the Texas tort system or under the workers' compensation system (subject to the caveats above) when differences in firm technology and industrial mix between the two sectors are taken into account. Indeed, for most industries, the real level of safety is not that different between the two sectors as indicated by fatality rates (see Table 1). Because fatal injury rates are both hard to fake and difficult to ignore, they are a reasonable proxy for real level of workplace safety. They are calculated as the annual fatality rates per 10,000 employees, averaged over 1992 through 1994 (the sample period of analysis). With the notable exceptions of the mining/construction, transportation, and finance industries (their exceptional behavior is discussed at greater length below), the real level of workplace safety is slightly better among tort employers than among workers' compensation employers, though the differences are not that large given the rare nature of a fatal injury.

⁵ Some *ex ante* compensation may exist in the form of higher wages offered to workers exposed to greater risk, but the *ex post* injury compensation would not be available to employees under workers' compensation.

There are other justifications for a strict liability system (such as workers' compensation). It tends to reduce the transactions costs due to litigation since "negligence" is no longer a contentious issue, though this advantage is partially offset (in workers' compensation) by contentions over whether a given injury "arose out of, and in the course of, employment," and the end of a temporary disability.

Another rationale for a strict liability system exists where courts and juries can only imperfectly measure the "cost effective" precautions available to the employer. In this case, the employer may have less incentive to adopt all cost-justified precautions under a negligence standard than under a strict liability standard.

⁶ In the perfect information Coase model, a reduction in the expected liability cost would be fully offset by an increase in the wage premium required by informed workers. But even without full information, safety incentives do not disappear. If the employee bears more of the accident costs, he or she will have more incentive to take care. Also, there are other reasons besides workers' compensation costs that the firm will want to engage in safety, such as preserving the stock of specific human capital at the firm.

Table 1
Fatality Rates (Number of Fatalities per 10,000 Employees)
by Industry, Averaged over 1992 Through 1994

Industry	Nonsubscribing Firms	Subscribing Firms
Agriculture	0.86	1.72
Mining/Construction	11.10	4.96
Nondurable Manufacturing	0.92	1.47
Durable Manufacturing	0.70	0.91
Transportation	8.08	3.29
Trade	1.11	1.74
Finance	2.01	0.51
Other Services	1.74	1.29
Health Services	0.22	0.21
Tax Exempt	0.62	7.45

Even where the real level of safety is the same on average for tort and workers' compensation employers, it does not follow that the reported injury rates will necessarily be the same. Considerable empirical evidence indicates that the safety behaviors of firms and workers are imperfectly measured, and that because of this informational asymmetry, moral hazard problems abound in workers' compensation (see Butler and Worrall, 1991, and references cited therein).

Moral hazard arises when the presence of insurance changes the behavior of those who are insured. Employees' behavior may change since insurance lowers the cost of receiving medical care when treating the injury, and it lowers the cost of missing work while receiving indemnity payments. Although workers may collectively pay for these benefits through reduced wages (see Chelius and Burton, 1994), individually they have incentives to consume more medical care or take more time on a claim than they would have without workers' compensation insurance as long as monitoring the true extent of their injury is difficult. Moral hazard also affects health care providers, because they can sometimes increase their incomes by classifying relatively more medical conditions as work related.

Insurance may also affect the behavior of employers, working in the opposite directions of employee incentives. As long as employers' actions are difficult to monitor, imperfect information provides employers with incentives to deny what otherwise might be legitimate claims. If this is the case, then medical costs and severity would be lower in workers' compensation than they would be if the firms' behavior were perfectly observed.

The extent to which these types of moral hazard manifest themselves is an empirical question. Previous research suggests that, if employer moral hazard exists, it is overshadowed by employee moral hazard: in most data sets analyzed, workers' compensation costs per employee over the last 25 years have been rising more rapidly than statutory benefits.⁷ This implies that claim frequency or severity

⁷ The exception is the study by Krueger and Burton (1990), who find that costs rise proportionately with benefits, suggesting either no moral hazard effects for employees or offsetting effects between employees and employers.

has also been increasing as statutory benefits increased in other states and in earlier years (in fact, both claim frequency and claim severity have been increasing on average—see Butler, 1994, for references).

TEXAS MARKET FOR WORK INJURIES

Approximately 44 percent of Texas employers have opted out of the workers' compensation system, leaving themselves open to potentially unlimited legal liability for work related accidents and diseases. In Texas, to show that an employer is liable, the employee must show that the employer failed in its duty to provide a safe working environment, including providing a safe workplace, having a sufficient number of workers for any particular project, selecting competent fellow workers, furnishing employees with safe and suitable tools, and instructing employees in appropriate safety techniques (Thornton, 1991).

Although firms of all sizes choose to opt out of the workers' compensation system, there are a disproportionate number of smaller firms in the opt-out group. Because more medium and large firms participate in workers' compensation, only about 20 percent of workers are not covered by workers' compensation insurance. Since most employers, both those who subscribe to workers' compensation and those who opt out, are required to file accident reports with the Texas Workers' Compensation Commission, comparisons of differences in outcomes can be measured. These comparisons are especially useful since self-insurance has been possible only in the last two years, and the requirements for self-insurance have been so severe that relatively few firms are allowed to self-insure.⁸

Given the discussion on moral hazard above, it seems likely that tort employers will face different incentives than workers' compensation employers. Not only could legal incentives vary as the issue changes from "negligence" to "employment relatedness," but indemnity costs will vary as well.⁹ In the following sections, the accident and severity experience of those who participate in the Texas workers' compensation system (the "subscribers") is compared with those who don't (the "nonsubscribers") and who are, therefore, subject to the tort system.

⁸ See footnote 14 below detailing the change in reporting requirements by firm size for nonsubscribers. Another reason that relatively few firms self-insure is because of the increasing use of large deductibles in workers' compensation in Texas. Since the implementation of the large deductible program in 1992, the written premium volume of the workers' compensation market has shrunk from \$4.2 billion to approximately \$2 billion, with nearly all of that drop accounted for by premium credits to policies with deductibles, according to the Texas Workers' Compensation Research Center.

⁹ Medical costs also may vary for moral hazard reasons, even where the injured worker is covered by other employer-provided insurance. Partly this is the result of workers' compensation providing first-dollar coverage for medical costs and less use of managed care techniques relative to other forms of medical insurance. And partly, in Texas at least, it is an increased ability by the tort employer to direct workers to selected (usually occupational) health care providers, in exchange for full coverage of medical costs. Medical costs are not discussed at any length in the next few sections because medical costs for tort employers are not readily observed. However, anecdotal evidence suggests that medical costs are much lower among tort employers than among workers' compensation employers.

Many of the larger nonsubscribers have various insurance policies to help cover some of their medical and lost work time costs (for temporarily injured workers) and so are subject to some of the moral hazard responses described above. To the extent that these policies cover all workers and offer the same sort of universal injury protection, with the same degree of experience rating, subscribing and nonsubscribing firms are expected to have similar moral hazard responses and, hence, similar claims distributions.

But differences in the types of insurance offered between the two sectors are expected to generate different moral hazard responses. First, many firms report that they opt out in order to improve their control over injured workers' medical costs (injured workers have the right to choose their physician under Texas workers' compensation statute). This is likely to increase the information available to the opt-out employer about the true nature of the injury. Second, not all nonsubscribing firms have policies that specifically cover occupational injuries and lost wages (for temporary total injuries). Third, only larger firms are experience rated in workers' compensation. Most firms are not experience rated and so changes in their insurance costs do not reflect changes in their accident distributions. This reduces their safety incentives relative to the nonsubscribers for whom insurance costs are closely linked to accident costs. That is, there is likely to be a greater return to claims prevention activities for nonsubscribers. Fourth, although most nonsubscriber employees are covered by a temporary disability indemnity plan, very few are covered by a formal permanent partial disability plan. This means that most of the injuries (medical only and temporary total claims) are treated more or less as they would be under workers' compensation, but many of the more severe, chronic injuries are not.¹⁰

Since all injuries recorded in our sample begin as "temporary total" injuries (they are included only if there is more than one lost work day), there may not be an observable difference in reported accident rates due to moral hazard. This is because "temporary total" injuries are generally covered by both subscribers and nonsubscribers. Indeed, many of the written ERISA plans for the nonsubscribers offer temporary total benefits to the injured employee the first day off of work, without being subject to the waiting period in the workers' compensation system—

¹⁰ According to survey results of Dyer et al. (1993), 35 percent of nonsubscribing employers pay occupational benefits. But since 94 percent of the larger firms (100 or more employees) provide occupational benefits, 70 percent of the employees of nonsubscribers have some form of occupational medical benefits, and 64 percent of employees of nonsubscribers have some form of wage replacement benefits.

But while most of the nonsubscribing employers provide similar benefits to their employees for temporary injuries, the majority of the nonsubscribing firms surveyed by Dyer et al. (1993) pay for those benefits out of pocket rather than through insurance. Seventy percent of the employees are covered by nonsubscribers who pay their wage replacement benefits out of pocket, and 55 percent of the employees are covered by nonsubscribers who pay their medical benefits out of pocket. There is no systematic difference between large and small firms in the propensity to pay out-of-pocket expenses. Since the benefit expenses are directly related to the loss experience of the firm (and are not for workers' compensation firms, which are only manually rated), moral hazard incentives to the nonsubscriber employers are greatly reduced relative to those who are not perfectly experience rated in workers' compensation.

a major reason why nonsubscribers may actually have higher reported accident rates than subscribers.¹¹

But average claim severity is expected to be greater for subscribers since very few nonsubscribers guarantee that they will pay permanent partial benefits. Hence, moral hazard differences related to the treatment of chronic health conditions should result in relatively longer reported durations for any given type of accident, and relatively more reported chronic conditions (i.e., more sprains and strains, fewer cuts and fractures) among employees covered by workers' compensation. The next section presents evidence consistent with such differential moral hazard responses between the workers' compensation (subscribing) firms and the tort (nonsubscribing) firms in Texas. In particular, the empirical evidence is consistent with the following hypotheses:

Accident frequency is slightly greater among nonsubscribers than subscribers.

Subscriber firms experience substantially greater accident severity (in the form of longer reported lost work day durations) than nonsubscriber firms experience.

Subscribers report relatively more chronic conditions (i.e., strains and sprains) than nonsubscribers.

ACCIDENT RATES FOR SUBSCRIBERS AND NONSUBSCRIBERS

The data in this and the next two sections come from the Texas Workers' Compensation Commission (TWCC). The basic information for subscribers comes from "Employer's First Report of Injury or Illness" forms, which are filed for all injuries with more than one lost work day. The basic information for nonsubscribers comes from "Noncovered Employer's First Report of Injury or Illness" forms, which are also filed for all injuries with more than one lost work day. (A lost work day does not include the initial date of injury.) Hence, sample inclusion is on the same basis for both groups. So whenever we discuss severity (days out of work due to an injury) or frequency (number of accidents per employee), it is for those workers (and firms with such workers) who have had more than one lost work day. Because differences in industrial mix between the tort and workers' compensation sectors is important, and because industrial differences are known to affect claims rates and severity, the data are partitioned throughout on the basis of industrial types (one-digit and two-digit standard industrial classification [SIC] codes). Table 2 presents the means of key demographic variables for both data sets (where SIC is not missing). Since only about 20 percent of the workforce is employed by nonsubscribing firms, it is a much smaller sample than the subscriber firm sample.

¹¹ Worrall and Appel (1982) estimate the elasticity of temporary total indemnity to medical only claims with respect to the replacement rate to be about 0.6 using Texas data. That is, a 50 percent increase in benefits should lead to a 30 percent increase in the relative number of indemnity claims. Since workers' compensation benefits are zero during the waiting period and 70 percent of wages after the waiting period (subject to minimum and maximum benefits), it would not be surprising—given the relatively large elasticity estimated by Worrall and Appel—to find a significantly higher reported injury among nonsubscribing employers paying first day indemnity costs.

Table 2
Variable Means by Industry

	Age			Male			Hourly Wage		
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
<i>Panel A: Nonsubscribing Firms</i>									
All Industries	33.11	11.21	39,615	0.572	0.494	49,114	6.50	2.93	22,375
Agriculture	34.77	11.81	360	0.865	0.684	497	5.28	1.67	314
Mining/Construction	31.84	9.20	729	0.954	0.209	984	7.97	2.54	543
Nondurable Manufacturing	31.52	9.30	5,428	0.735	0.441	6,210	6.78	1.90	3,502
Durable Manufacturing	36.68	11.65	2,690	0.820	0.384	3,454	7.18	2.50	1,797
Transportation	37.55	9.32	3,113	0.912	0.28	3,831	7.07	3.28	1,293
Trade	29.64	11.20	14,577	0.573	0.495	17,086	5.89	2.53	7,207
Finance	32.54	9.76	552	0.603	0.489	812	7.20	2.77	339
Other Services	34.37	11.05	3,312	0.644	0.479	4,322	5.97	2.40	2,161
Health Services	37.16	10.92	8,151	0.207	0.405	10,986	6.95	4.08	4,684
Tax Exempt	32.29	10.84	700	0.545	0.498	932	6.29	2.26	517
<i>Panel B: Subscribing Firms</i>									
All Industries	37.06	16.30	180,031	0.627	0.484	180,031	10.52	7.20	147,401
Agriculture	36.82	11.07	4,630	0.694	0.461	4,630	10.14	7.26	3,759
Mining/Construction	36.47	10.78	16,992	0.941	0.236	16,992	10.19	6.13	14,700
Nondurable Manufacturing	37.29	10.97	13,689	0.678	0.468	13,689	11.98	9.04	10,729
Durable Manufacturing	37.33	10.62	20,584	0.746	0.435	20,584	11.66	7.45	17,923
Transportation	37.50	10.21	10,756	0.842	0.365	10,756	11.45	6.03	8,673
Trade	32.61	11.33	31,631	0.634	0.482	31,631	8.17	5.46	27,481
Finance	37.51	11.23	2,540	0.415	0.493	2,540	9.67	5.92	2,124
Other Services	33.92	11.07	11,010	0.700	0.458	11,010	8.56	5.95	8,106
Health Services	40.69	11.33	48,228	0.337	0.473	48,228	11.38	8.65	36,724
Tax Exempt	36.99	10.14	19,969	0.746	0.435	19,969	11.31	5.37	17,182

Note: S.D. = standard deviation. N = number of observations.

The demographic differences between the subscribing and nonsubscribing employees are quite pronounced (and, again, probably indicates sample selection): injured workers in subscriber firms are more likely to be male, older, and better paid than their nonsubscriber counterparts. Except for transportation and other services, injured subscriber employees are significantly older. On average, the injured subscriber employee is 37 years old, while the injured nonsubscriber employee is 33 years old (column 1, for all industries combined). Injured subscriber employees are also more likely than nonsubscriber employees to be male (62.6 percent versus 57.2 percent). Being older and male accounts for some, but not all, of the difference in pay.¹² The average hourly wage for injured subscriber em-

¹² Some of the difference in pay is also probably due to firm size. However, the Texas Employment Commission would not release data on firm size associated with the individual claim records because of confidentiality concerns, and so I was not able to explore the effect of firm size on employer costs in this study.

ployees is \$11.51, almost 60 percent higher than the \$6.50 hourly wage for injured nonsubscriber employees. These differences suggest that controlling for the demographic characteristics of injured workers may be important when examining the impact of nonsubscription.

Table 3 presents data on the injury rates for subscribers and nonsubscribers, both for one-digit and selected two-digit SIC codes (the two-digit SIC codes are based solely on the number of observations available from the smaller, nonsubscriber data set). Injury rates are calculated by summing the number of accidents for each of the indicated industrial groups and then dividing by the number of employees in the claimants' respective firms. This denominator, number of employees in the firm, is not available in the TWCC data sets but is available on magnetic tape from the Texas Employment Commission.

Although I was not allowed access to the Texas Employment Commission data for reasons of confidentiality, the TWCC together with the Texas Workers' Compensation Research Center calculated the denominator for the level of aggregation indicated in Table 3. I provided the encrypted employer identification numbers that they had supplied in the data tapes for observations without missing SIC codes, and they returned aggregate employment counts for those firms.

There is a comparability problem with the data in Table 3. The data for 1994 in the right-hand column are based on claims generated only through September 1994 and are not comparable with 1993 or 1992 data. Since the 1994 data are based on the same part of the year for both subscribers and nonsubscribers, however, they are comparable between sectors. Two potential sources of relative bias arise when comparing subscribers and nonsubscribers: the nonreporting of accidents that legitimately should be reported may systematically vary between these two sectors, and one sector may have relatively more "no accidents" than the other.¹³ Obviously, the accident rate will be overstated to the extent that firms with no reportable injuries are not included in the denominator as part of the population at risk, but should be. This imparts an upward bias to the data but has an unknown impact on the relative number of subscriber to nonsubscriber injury

¹³ Although currently the penalty for nonreporting is the same in both sectors (a \$500 fine), during the sample period there was no penalty for nonreporting to nonsubscribers. Hence, the financial incentive to report injuries was greater for subscribers. The overall number of injuries reported indicates that there is relatively more under-reporting among nonsubscribers. Under the strong assumption that the rate of "true," "reportable" injuries is the same for both groups, then it can be shown that only about one in four injuries are being reported to the Texas Workers' Compensation Commission in the sample period. Because of this potential difference, all the statistics reported in this article are based on the employers' actually reporting accidents. Under-reporting should not affect the results except to the extent that those not reporting in any given system vary systematically from those reporting information in that system.

Table 3
Injury Rates (Number of Fatalities per 10,000 Employees) Among
Nonsubscribing and Subscribing Firms Reporting at Least One Accident

	1992	1993	1994 ^a
<i>Panel A: Nonsubscribing Firms</i>			
<i>One-Digit SIC Industries</i>			
Agriculture	0.035	0.055	0.035
Mining/Construction	0.153	0.088	0.091
Nondurable Manufacturing	0.093	0.103	0.084
Durable Manufacturing	0.057	0.056	0.053
Transportation	0.326	0.168	0.126
Trade	0.110	0.098	0.077
Finance	0.109	0.072	0.040
Other Services	0.040	0.050	0.041
Health Services	0.052	0.054	0.046
Tax Exempt	0.055	0.034	0.029
<i>Two-Digit SIC Industries</i>			
Food Manufacturing	0.161	0.166	0.140
Textiles	0.045	0.063	0.068
Fabri. Metal	0.060	0.050	0.038
Trucking	0.324	0.223	0.169
Nondurable Wholesale Trade	0.069	0.077	0.060
Food Stores	0.179	0.132	0.121
Auto Dealers/Service Stations	0.062	0.041	0.055
Restaurants	0.088	0.086	0.071
Hotels	0.027	0.050	0.032
Personal Services	0.100	0.080	0.036
Business Services	0.028	0.037	0.036
Medical Services	0.049	0.050	0.040
<i>Panel B: Subscribing Firms</i>			
<i>One-Digit SIC Industries</i>			
Agriculture	0.032	0.046	0.040
Mining/Construction	0.052	0.057	0.042
Nondurable Manufacturing	0.048	0.067	0.045
Durable Manufacturing	0.046	0.041	0.034
Transportation	0.077	0.081	0.085
Trade	0.119	0.132	0.124
Finance	0.028	0.030	0.030
Other Services	0.046	0.051	0.039
Health Services	0.022	0.021	0.014
Tax Exempt	0.139	0.228	0.139

(Continued)

Table 3 (Continued)

	1992	1993	1994 ^a
<i>Two-Digit SIC Industries</i>			
Food Manufacturing	0.066	0.088	0.068
Textiles	0.022	0.083	0.105
Fabri. Metal	0.039	0.040	0.035
Trucking	0.089	0.110	0.064
Nondurable Wholesale Trade	0.049	0.042	0.035
Food Stores	0.404	0.715	0.550
Auto Dealers/Service Stations	0.047	0.047	0.036
Restaurants	0.059	0.078	0.069
Hotels	0.032	0.033	0.030
Personal Services	0.039	0.068	0.021
Business Services	0.027	0.036	0.031
Medical Services	0.024	0.019	0.017

^a 1994 injuries are only for part of the year (through September 1994) and are therefore understated.

rates.¹⁴ The overall bias induced by either the nonreporting of accidents, or by the fact that "no accident" firms are not included, is not known. However, if the "no accident so no report" bias is relatively more significant in one sector than the other, then dividing through by the total employment in that sector (rather than the employment in those firms that report an accident as is done with the data presented in Table 3) should reveal systematic variations in the accident rates. In fact, no such systematic variation was found, and these biases—if they exist—are

¹⁴ A subtle issue concerns changes in the size of nonsubscribing firms that are covered by the reporting requirements (150 or more employees in 1992, 50 or more employees in 1993, and 5 or more employees in 1994). Since I have the actual employment and injury counts in each year for those with reportable injuries, these changes won't affect the rates (or the comparison of rates between sectors) except to the extent that they are significant injury rate differences between small firms and medium-sized firms. Although we don't have independent information on injury rates between small and medium-sized nonsubscribing firms in Texas, all the information on other firms that we do have (starting with the analysis by Russell, 1974) suggests that small firms actually have lower injury rates than medium-sized firms. This would suggest that the omission of relatively small firms in 1992 and 1993 is likely to induce an upward bias in the nonsubscriber rates for those years. Indeed, the change in the reporting requirement for nonsubscribers does seem to provide, at best, very weak support for an upward bias as the relative number of claims decreases only slightly in 1994 when the covered population of nonsubscribing firms does.

probably not large.¹⁵

With these caveats in mind, it is interesting to note that the accident rates for the subscribers and nonsubscribers are fairly close except in the transportation, finance, mining/construction, and tax exempt industrial groups. Accident rates are much higher for nonsubscribers than for subscribers in transportation, finance, and mining/construction and are much lower for nonsubscribers than for subscribers in the tax exempt sector.¹⁶ The three industries with higher nonsubscriber injury rates also have the smallest proportion of employees in nonsubscription status (in mining/construction, only 9 percent of the workers are employed by nonsubscribers; in finance, 9 percent; and in transportation, 11 percent in a 1995 survey).¹⁷ The injury and fatality rates in these three industries are consistent with the self-selection of the worse firms into nonsubscription status. But where there are relatively more employees in nonsubscription firms, the differences between sectors in reported lost-time injuries is small. An independent (but small) random survey of subscribers and nonsubscribers (Dyer et al., 1994, p. 44) also finds no statistically significant difference in injury rates after controlling for industry differences. For industries with a sizable fraction of employees in nonsubscription

¹⁵ Estimates of employment in both sectors are published in Dyer et al. (1993) and are used as the denominators with actual number of accidents calculated from the TWCC tapes as the numerator. The resulting accident rates were as follows

Industry	Nonsubscriber Adjusted Accident Rate	Subscriber Adjusted Accident Rate
Agriculture	0.0069	0.0140
Mining/Construction	0.0045	0.0114
Manufacturing	0.0223	0.0130
Transportation	0.0273	0.0069
Trade	0.0108	0.0088
Finance	0.0068	0.0025
Other Services	0.0049	0.0038
Health Services	0.0220	0.0363

¹⁶ The tax exempt group (one-digit SIC = 9) may present significant problems, and this is another reason why it is imperative to analyze differences on an industry-by-industry basis. The first problem with this code in Texas is that employers with a one-digit SIC code equal to nine are either public administration, churches and other organizations claiming tax-exempt status, or nonclassifiable establishments. Employers classified as public administration should be subscribers to the workers' compensation system as prescribed by statute (Texas Labor Code, Chapter 406, Section 406.002). Therefore, the mix within the tax exempt group would be expected to be quite different for subscribers and nonsubscribers. In addition, the staff at the Texas Workers' Compensation Research Center has indicated some data problems associated with Texas Employment Commission employment data on public entities. Since this was the ultimate source of information for the denominator in Table 2, this suggests further caution in making comparisons between the tax exempt groups for subscribers and nonsubscribers.

¹⁷ These numbers are found in *The Research Review* (April 1995, Figure 2) and are the three lowest of all of the industries listed. The corresponding percentages for 1993 are mining/construction, 8 percent; transportation, 9 percent; and finance, 13 percent (Dyer et al., 1993, Figure 3).

The unusually large accident rate for the tax exempt subscriber group may be attributed to the problems discussed in footnote 16.

status, the data presented in Table 3 lead to a different conclusion: a slightly higher rate of accidents occurs among nonsubscribers than among subscribers.

SEVERITY BY INDUSTRY

The outcome measure employed here is "injury" severity, as measured by the number of days lost from work. In the nonsubscriber data, information on lost work days is reported in the form of a binary variable: either two to seven days lost work time or eight or more days lost work time. In the subscriber data set, comparable information is reported on claim type: a "reportable" claim with two to seven days of lost work time or an "indemnity" claim with eight or more days lost work time. To make the comparison as clean as possible, inference concerning duration is based on these proportions in both data sets. Table 4 presents two statistics: estimated average time to return to work based on maximum likelihood estimates using information from the aggregated groupings of claims and the percentage of cases in which lost work days equal eight or more.

When measuring the duration before return to work, it is important to control the industrial mix between subscribers and nonsubscribers. Industry is important because firms in different industries are exposed to inherently different risks: firms across different industries are not likely to randomly self-select themselves into nonsubscription status.¹⁸ The subscriber tapes contain 896,355 records for this period. Research personnel at TWCC indicated that these are updated information on the claims (only the most recent data are included for each claim—i.e., there are no duplicate records of the same claim). Missing data on claim type (whether it was a "reportable" or "indemnity" claim) reduced the sample slightly to 806,699. Missing SIC codes further reduced the sample to about 170,353 observations (the number of observations used in Table 4 for the subscribers). This large reduction has no impact on the aggregate reported durations, as can be seen in Table A1 of the Appendix.

The data for nonsubscribers also come from computer tapes supplied by TWCC. These data are carefully monitored so that there is complete information on SIC codes for all injuries reported (i.e., the reports are not accepted until the SIC is included). The sample was reduced from 49,114 to 40,519 because of missing data on lost time (the number of observations used for Table 4 for non-subscribers).

Average lost time due to injury is given in the upper panel of Table 4 for one-digit SIC firms and in the lower panel for selected two-digit SIC firms.¹⁹ Also given are the percentages of workers with lost time greater than one day whose return to work was eight or more days. In the agricultural sector covered by workers' compensation, for example, of the cases where lost time was greater than

¹⁸ As a fraction of all employees in a given industry, workers in nonsubscribing firms are relatively over-represented in wholesale and retail trade, agriculture, and health and relatively under-represented in mining, construction, and transportation (Dyer et al., 1993, Figure 3).

¹⁹ These industries were chosen solely on the basis of the number of observations available in the nonsubscriber data set.

one day, 60 percent had lost time of eight 8 days or longer. Among agricultural workers not covered by workers' compensation insurance, of the cases where lost time was greater than one day, 43 percent were losses of eight days or longer.

Table 4
Average Number of Lost Work Days Due to Injury and the Percentage of Cases with Eight or More Lost Work Days

	Subscribing Firms		Nonsubscribing Firms	
	Average Number of Lost Work Days	% of Cases with 8 or More Lost Work Days	Average Number of Lost Work Days	% of Cases with 8 or More Lost Work Days
<i>One-Digit SIC Industries</i>				
Agriculture	11.59	60	7.05	43
Mining/Construction	9.50	53	7.63	46
Nondurable Manufacturing	8.52	49	5.76	35
Durable Manufacturing	8.36	48	6.68	41
Transportation	9.21	52	7.65	46
Trade	5.93	36	5.89	36
Finance	6.10	37	5.15	31
Other Services	6.73	41	5.60	34
Health Services	6.03	37	5.77	35
Tax Exempt	6.73	41	4.40	26
<i>Two-Digit SIC Industries</i>				
Food Manufacturing	9.30	52	5.95	36
Textiles	7.36	44	5.71	35
Fabri. Metal	8.24	48	6.40	39
Trucking	13.29	64	7.77	46
Nondurable Wholesale Trade	8.93	51	6.27	38
Food Stores	6.26	38	6.66	41
Auto Dealers/Service Stations	5.78	35	9.25	52
Restaurants	6.17	38	5.22	32
Hotels	6.27	38	4.30	25
Personal Services	9.93	55	8.39	49
Business Services	7.92	47	6.60	40
Medical Services	6.93	42	5.87	36

Indeed, in all ten of the one-digit SIC comparisons and in ten of the twelve two-digit SIC comparisons, the subscriber employees reported longer durations for injuries than nonsubscriber employees. This pattern is consistent with the hypothesized moral hazard differential between the two systems: because longer, "permanent" conditions generally are not covered by nonsubscription benefit plans, we are less likely to observe the longer lived lost time "claims" among non-subscribers.

To convert the binary severity variable to durations, I assumed that the durations of claims were exponentially distributed and calculated the implied durations (see the Appendix for more details on this calculation). These durations are calculated on the same basis for both groups—that is, from the number of “claims” that are from two to seven days and the number that are eight days or longer. Overall, the duration of lost work time for injured agricultural workers in subscriber firms was about 50 percent longer for injured agricultural workers in nonsubscriber firms: 11.59 days for subscribers, 7.05 days for nonsubscribers (see Table 4). The data in Table 4 suggest that employees covered by workers’ compensation spend from 10 to 50 percent longer on a lost work time episode than employees not covered by workers’ compensation, consistent with the expected moral hazard response given the differential insurance coverage.²⁰

Correlates of Duration

Most of the difference in employer “indemnity”/lost work time costs is obviously the result of the large differences in durations between the subscribers and nonsubscribers. How much of this difference can be explained by differences in the age, sex, and wages of the two groups? Maximum likelihood estimates of the determinants of claim duration for the two groups are calculated in order to address this issue (see Table 5). For both data sets, I used the PROC NLIN in SAS to estimate the likelihood function given in the Appendix.²¹ The PROC NLIN standard

²⁰ The use of estimated durations to infer injury severity is not likely to significantly bias relative (ratio) comparisons of $\frac{\text{subscriber days}}{\text{nonsubscriber days}}$, but may bias comparisons of the absolute

differences between the two groups in unknown directions. Suppose, for example, that the duration came from any member of the generalized gamma family (of which the lognormal, gamma, Weibull, and exponential distributions are special or limiting cases), in which the mean parameters (β_s , β_{ns}) varied by workers’ compensation status but the other parameters (α , ρ) did not. Then the relative means would be

$$\frac{\text{mean subscriber days}}{\text{mean nonsubscriber days}} = \frac{\beta_s \Gamma(\rho + 1/\alpha) / \Gamma(\rho)}{\beta_{ns} \Gamma(\rho + 1/\alpha) / \Gamma(\rho)} = \frac{\beta_s}{\beta_{ns}}$$

so the bias would arise from the relative bias in the estimated mean parameter, when we assume that the distribution is exponential and it is really generalized gamma. The absolute difference, on the other hand, is estimated as

$$(\text{mean subscriber days}) - (\text{mean nonsubscriber days}) = (\beta_s - \beta_{ns}) \Gamma(\rho + 1/\alpha) / \Gamma(\rho)$$

indicating that, even if the mean parameters are estimated consistently, the true difference in means may be significantly larger or smaller than the estimated means because of the right-hand terms.

²¹ Both sets of estimates are comparable in the sense that they are based on maximum likelihood methods and employ the Weibull distribution with distribution function $F(t) = 1 - \exp(-(t/\beta)^\alpha)$, where the mean parameter beta is assumed to be a function of the claimant characteristics (a vector x) given in Table 5: $\beta = \exp(\gamma'x)$. Estimates of γ are given in Table 5. Since for each individual in the nonsubscription group, we only observe whether they are on one of two claim segments (two to seven

errors are known to be too conservative (too large) relative to other maximum likelihood programs. Besides PROC NLIN's conservative criterion for generating the standard errors, the other reason for the large standard errors shown in Table 5 is that there is relatively little information about the duration contained in the duration dummy variables.²²

Table 5
Maximum Likelihood Estimates of the Determinants of Claim Duration

	Nonsubscribing Firms				Subscribing Firms			
	No Year Effects		Year Effects		No Year Effects		Year Effects	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Intercept	1.030	30.34	0.897	1.70	1.196	10.19	1.348	2.12
Male	0.033	0.69	0.36	0.045	0.008	0.06	0.004	0.01
Age	0.019	0.39	0.019	0.02	0.031	0.24	0.031	0.06
Age Squared	-0.00007	0.00	-0.00006	0.00	-0.00028	0.00	-0.00028	0.00
Wage	0.008	0.16	0.008	0.01	0.002	0.01	0.002	0.00
Agriculture	—	—	—	—	0.535	4.16	0.496	0.88
Mining/Construction	0.305	6.33	0.331	0.35	0.303	2.35	0.322	0.574
Nondurable Manufacturing	0.074	1.53	0.060	0.10	0.227	1.77	0.228	0.41
Durable Manufacturing	0.208	4.30	0.225	0.24	0.210	1.64	0.211	0.38
Transportation	0.294	6.11	0.319	0.34	0.259	2.02	0.272	0.49
Trade	0.139	2.89	0.150	0.16	-0.086	0.67	-0.078	0.14
Finance	0.015	0.31	0.016	0.11	-0.136	1.06	-0.127	0.23
Other Services	-0.048	1.03	-0.052	0.09	0.034	0.27	0.039	0.08
Health Services	-0.036	0.78	-0.029	0.08	-0.077	0.60	-0.067	0.12
1992	—	—	0.623	0.65	—	—	-0.290	0.52
1993	—	—	0.089	0.10	—	—	-0.304	0.54
α	1.053	22.44	0.995	1.03	1.036	8.05	1.002	1.78
N	21,148		21,148		134,711		134,711	
Log-likelihood	10,426.84		10,369.91		90,660.56		89,943.27	
Chi-square ($\alpha = 1$)	4.057		0.006		0.426		0.124	

Specifications include and exclude year effects. The weekly wage is included because of its importance in other studies of moral hazard behavior, but workers' compensation benefits are excluded since workers in nonsubscriber firms are not eligible for such benefits. Surprisingly, however, the wage effect is quantitatively

days, or more than seven days), the maximum likelihood was written to take this into account. Details are given in the Appendix.

²² In estimation of continuous durations models using the Texas (subscriber) data set, the SAS procedure LIFEREG gives the same coefficient estimates for the variables but gives standard errors that were from 5 to 20 times smaller than those given by the NLIN procedure for the same Weibull specification. Unfortunately, LIFEREG was not flexible enough to allow for the discrete reporting nature of the data used here. Also, likelihood ratio tests confirm the LIFEREG results and reject the null hypothesis of no effect for many of the variables even though the t-statistics in the NLIN procedure indicated otherwise.

small and statistically unimportant. The year effects are statistically significant for the subscriber data set but not for the nonsubscriber data set (on the basis of likelihood ratio tests). It is unclear whether the statistical significance of the year effects for workers' compensation firms is correlated with the impact of Senate Bill 1 (a very significant workers' compensation reform law) or just the general improvement across the United States in the workers' compensation underwriting market.

The estimated scale parameter, α , is a common measure of how time spent on a claim affects the probability of return to work. If longer durations of joblessness tend to increase the probability of return to work for those still on a "claim," then α will be greater than one and there is said to be "positive duration dependence." On the other hand, a value of α close to one indicates that longer durations have no impact on return to work probabilities for those still on a claim. The Chi-square tests of the models with and without the restriction that $\alpha = 1$ cannot reject the restriction (except in the far left-hand column at about the 0.035 level), indicating that there appears to be no duration dependence in the sample. That is, an α close to one indicates that duration time is exponentially distributed. This supports the use of the exponential distribution in calculating the durations given in Table 4.

Men have fewer lost work days than women for subscribing firms (consistent with research findings reported from other samples of workers' compensation claims), but men in the nonsubscribing firms actually have more lost work days than women. Women covered by workers' compensation are likely to have durations of lost work time that are about 0.8 percent shorter than men covered by workers' compensation; women not covered by workers' compensation have durations that are about 3.5 percent shorter than men not covered. Since there are more men in the subscriber group, the means in Table 4 for subscribers should be adjusted downward to account for the fact that men tend to have longer spells of job loss. This adjustment doesn't appreciably change the difference in means.²³ Higher wages have a small tendency to increase the time spent on a claim in both sectors, though the effect is virtually zero and statistically insignificant in both cases (based on log-likelihood ratio tests).

²³ The mean of the Weibull distribution as it has been specified here is $E(t) = \beta \Gamma(1 + (1/\alpha))$. So the percentage difference in mean duration, given that $\beta = \exp(\gamma'x)$ —where x is a vector of individual claimant characteristics and γ is their corresponding estimate effects—is given as

$$\ln \left(\frac{\beta_s \Gamma(1 + \frac{1}{\alpha_s})}{\beta_n \Gamma(1 + \frac{1}{\alpha_n})} \right) = \gamma_s' x_s - \gamma_n' x_n + \ln \Gamma(1 + \frac{1}{\alpha_s}) - \ln \Gamma(1 + \frac{1}{\alpha_n}).$$

The last two right-hand terms are constants that are virtually equal in value given the similarity of the estimates of α . That is, the last two terms cancel and I ignore these terms here. The first two right-hand terms can be factored into the usual Oaxaca regression decomposition by various well-known ways of grouping terms. We take the average of the two coefficients and then multiply this by the difference in the mean characteristics to adjust for the respective demographic factor. For the male variable, this is $(0.004 + 0.036)/2 * (0.627 - 0.572) = 0.0011$.

Age has an important nonlinear impact for the two groups, increasing claim severity during prime age working years at differential rates. Among the subscribers, duration increases with age until 55 years of age, and then decreases with age thereafter. That is, among subscribers, there is a relatively flat age effect from 50 to 60 years of age. Among nonsubscribers, duration increases with age throughout the working life, though at a decreasing rate. On the basis of the estimated age effects (the age and age squared variables), the slightly older workers in the subscriber sample would be expected to have claim durations that are about 5 percent higher than those of nonsubscribers. This means that all of the demographic variables together would explain slightly more than 5 percent of the difference in the means between subscribers and nonsubscribers. Since the actual difference in means is several times greater than this, demographic characteristics do not explain the substantial differences in lost work day experience observed in Table 4.

Industry effects also vary by subscriber status, although the coefficients there are not completely comparable because multicollinearity forced me to drop the agricultural dummy variable in the nonsubscriber data set. In likelihood ratio tests, these industry effects are statistically significant.

THE DISTRIBUTION OF TYPES OF ACCIDENT BY SUBSCRIBER STATUS

As hypothesized, the observed frequency of injury is slightly higher for nonsubscribing firms, while the observed duration of lost work days is slightly longer for subscribing firms. The distribution of injury types also follows the pattern predicted by moral hazard response: because chronic, longer-term conditions are not generally covered by nonsubscriber plans but are covered by workers' compensation, there are relatively more chronic (strains and sprains) conditions among the employees of workers' compensation firms than there are among the employees of nonsubscriber firms.²⁴

The distribution of types of injuries for the six most common types of accidents is given in Table 6. The injuries include back strains and sprains, other strains and sprains, contusions, cuts, fractures, and all others. The injury types are calculated so that each row sums to 100 percent (except for rounding error): in agriculture, for example, 22.5 percent of the reported accidents are for back strain,

²⁴ In an earlier version of this article, the data were partitioned by nature of injury and SIC codes, and the analysis of the previous two sections was done for each of these cells. After discussions with the Texas Workers' Compensation Research Center, I reanalyzed the data separately by SIC code and by type of injury and uncovered a severe anomaly in the data set for subscribers (though not for nonsubscribers). As indicated in Table A1, there is no change in the sample characteristics when I delete for missing indemnity information nor for missing SIC codes in either sample, but there is a profound change for subscribers when I exclude observations for missing nature of injury variables. In particular, when we exclude for missing nature of injury values, the recorded duration of injuries increases substantially (so much so that for almost all of these partitions, the durations of subscribers are more than double those of nonsubscribers. For example, in the third row of Table A1, the proportion of indemnity claims rises from 42.8 percent to 58.1 percent when we exclude missing nature of injury values. The source of this anomaly is not clear; but it seems necessary to avoid using nature of injury when making inferences about the durations of claims.

Table 6
Percent Distributions by Type of Injury for
Nonsubscribing and Subscribing Firms

	Back Strains and Sprains	Other Strains and Sprains	Contusions	Cuts	Fractures	All Others
<i>Panel A: Nonsubscribing Firms</i>						
<i>One-Digit SIC Industries</i>						
Agriculture	22.5	20.2	6.7	20.2	4.5	25.8
Mining/Construction	19.0	21.4	12.4	11.4	6.2	29.5
Nondurable Manufacturing	9.4	35.0	5.7	8.4	2.2	39.2
Durable Manufacturing	17.1	19.9	8.8	16.2	6.4	31.7
Transportation, Communication, and Utilities	27.2	28.2	14.7	6.7	6.3	17.0
Wholesale/Retail	24.6	19.0	14.6	14.5	3.6	23.5
Finance, Insurance, and Real Estate	24.7	17.7	6.1	9.5	3.9	38.1
Other Services	24.2	25.1	14.1	10.5	5.6	20.5
Health Services	33.3	26.7	9.4	7.3	3.2	20.0
Tax Exempt	15.6	37.8	13.3	8.9	0.0	24.4
<i>Two-Digit SIC Industries</i>						
Food Manufacturing	6.9	38.6	4.7	4.7	1.6	43.3
Textiles	15.6	32.5	6.7	15.9	3.0	26.3
Fabri. Metal	18.7	15.9	11.2	21.6	6.9	25.4
Trucking	28.0	28.7	14.4	6.9	5.9	16.1
Nondurable Wholesale Trade	27.2	15.7	14.7	6.7	4.7	18.6
Food Stores	26.7	20.0	14.7	16.8	3.5	18.3
Auto Dealers/Service Stations	31.5	15.5	11.0	13.8	8.3	19.9
Restaurants	21.4	17.0	15.1	14.7	2.8	29.0
Hotels	20.1	23.9	16.2	12.1	9.7	24.4
Personal Services	24.6	31.1	11.7	1.9	8.6	17.2
Business Services	26.2	23.3	14.5	10.4	5.3	20.3
Medical Services	35.1	26.8	9.0	6.8	2.8	19.6
<i>Panel B: Subscribing Firms</i>						
<i>One-Digit SIC Industries</i>						
Agriculture	25.7	30.0	8.2	6.0	6.3	23.9
Mining/Construction	23.2	25.7	8.7	6.5	10.4	25.4
Nondurable Manufacturing	20.8	35.9	7.3	5.6	5.4	24.9
Durable Manufacturing	21.5	30.6	8.5	6.7	6.3	26.3
Transportation, Communication, and Utilities	25.4	32.2	10.3	4.8	6.0	21.3
Wholesale/Retail	25.3	29.7	11.9	9.4	5.3	18.3

(Continued)

Table 6 (Continued)

	Back Strains and Sprains	Other Strains and Sprains	Contusions	Cuts	Fractures	All Others
Finance, Insurance, and Real Estate	23.1	30.6	9.5	4.8	6.5	25.4
Other Services	22.7	31.7	10.5	7.0	5.3	22.6
Health Services	25.8	34.4	9.7	4.3	6.4	19.3
Tax Exempt	21.7	35.3	9.7	4.5	5.9	22.9
<i>Two-Digit SIC Industries</i>						
Food Manufacturing	22.7	34.6	8.1	5.7	4.9	24.0
Textiles	16.2	52.6	4.3	4.6	1.6	20.7
Fabri. Metal	19.8	24.5	9.6	9.9	8.8	27.3
Trucking	28.4	32.0	10.3	3.9	7.6	17.8
Nondurable Wholesale Trade	28.5	29.5	11.3	5.3	6.5	18.8
Food Stores	23.1	28.4	12.0	16.3	4.1	16.1
Auto Dealers/Service Stations	23.6	26.2	11.1	8.7	6.4	23.9
Restaurants	24.6	26.1	12.8	10.5	3.8	22.2
Hotels	25.8	28.0	10.9	6.0	5.0	24.3
Personal Services	23.8	36.7	9.8	4.8	6.1	18.8
Business Services	23.7	31.9	10.7	7.5	5.4	20.8
Medical Services	31.8	34.6	6.6	2.6	4.4	19.9

20.2 percent are other strains or sprains, and only 4.5 percent of the injuries are fractures. The data indicate that strains and sprains are the most common type of injury, followed by contusions and cuts, with fractures occurring most infrequently.

Relatively more strains and sprains and fewer cuts occur among subscribing employees than among nonsubscribing employees. In fact, for every industry listed, the proportion of strains and sprains is lower for nonsubscribers than the respective proportion of strains and sprains for subscriber employees. In almost every case, the proportion of cuts is higher for nonsubscriber employees than for the subscriber employees, as one might expect since cuts are readily measured and monitored (as to their work relatedness).²⁵

²⁵ What is surprising is that the proportion of fractures, which is readily monitored and so should be relatively higher for nonsubscribers since moral hazard potential is decreased, is actually higher among subscribers than nonsubscribers in 7 out of 10 cases. The problem is that, when fractures are a relatively larger share for subscribers, then "all other" injuries are a relatively smaller share for subscribers. Perhaps a substantial number of these "omitted" categories (including crushing injuries, burns, and amputations) are relatively easier to monitor than fractures, and this explains the difference.

COST DIFFERENCES: INDEMNITY AND LEGAL

Large intrinsic differences in the level of safety between the workers' compensation and tort firms in the mining/construction, transportation, finance, and tax exempt industries make intersector comparisons of moral hazard responses in these four industries difficult. But for the other six one-digit industries analyzed above, the differences in claim rates, durations of injuries, and type of accidents are consistent with moral hazard reporting responses. Although fatality rates are higher among workers' compensation employers in agriculture, nondurable manufacturing, durable manufacturing, and virtually identical in the health services industries, the reported workplace injury rate is actually lower and average duration of lost work days is higher for workers' compensation firms in these industries.

The lower injury rate in workers' compensation firms is partially due to Texas' seven-day workers' compensation waiting period that effectively lowers real indemnity benefits in the initial phase of an injury.²⁶ Claim migration from medical only to indemnity claims in the nonsubscription sector is consistent with the earlier analysis of Texas data by Worrall and Appel (1982). They estimate that a 10 percent increase in the replacement rate will lead to a 6 percent increase in the number of indemnity claims relative to medical only claims. A seven-day waiting period in workers' compensation reduces indemnity benefits to zero during the period that accounts for most of the lost work day claims.

Claims reporting moral hazard effects also explain why workers' compensation firms have higher average durations of claims and report relatively more sprains and strains. A lack of guaranteed coverage for longer-term, chronic conditions and more control over medical providers in the nonsubscribing sector considerably lessen both employee and provider incentives to report chronic, longer-term injury conditions. In most industries, tort firms have much shorter average durations of lost work days than workers' compensation firms and report many fewer sprains and strains.

To examine the impact of these moral hazard responses on lost work time costs, I use the estimates from the previous sections in order to calculate an "expected indemnity" cost index. This index measures the average costs per employee under the two systems if the workers were to be paid the same weekly indemnity for lost work time. An interesting question is who has the higher lost work day costs: among the six comparable one-digit industries, is the higher frequency among the tort employers offset by their lower severity of claims?²⁷

The relative indemnity cost index, calculated for each industry separately, is simply

²⁶ Of course, if a worker is injured longer than the retroactive period, indemnity payments for the initial waiting period are paid. This is not likely to be a significant factor in Texas, however, since it has a retroactive period of four weeks, much longer than most states (the average retroactive period in the United States is 14.8 days).

²⁷ This tends to overstate the actual benefits paid to nonsubscribing employees to the extent that they do not cover permanent partial injuries, and tends to understate it to the extent that they offer higher temporary total benefits than are available under workers' compensation. Dyer et al. (1993) compares some of the differences between a few nonsubscribing employers.

$$\frac{C^{NS}}{C^S} = \frac{\sum_{\text{injury types } i} P_i^{NS} D_i^{NS} B_i^{NS}}{\sum_{\text{injury types } i} P_i^S D_i^S B_i^S},$$

where i injury types = back strain, other strains, contusions, cuts, fractures, and all other injuries,

C^j = expected costs of the j th type (nonsubscriber, subscriber),

P_i = probability of i th type injury (where P_i = the industry-specific overall accident rate given in Table 3),

D_i = industry specific durations from Table 4, and

B_i = average daily workers' compensation benefit for the i th injury type.

For the purposes of comparison, it is assumed that the benefits are comparable for the two sectors, so the relative cost index is equivalent to a relative days lost index.

Table 7 presents the calculations of those data. An index value of one indicates equal costs per worker, an index value less than one indicates that nonsubscribers have fewer days lost per worker, and an index value greater than one indicates that subscribers have fewer total days lost per worker.

Since the intrinsic higher risk in mining/construction, transportation, and finance is much higher among nonsubscribing employers, it is not surprising that nonsubscribing (tort) employers in these industries have higher costs of lost time than do their subscribing (workers' compensation) counterparts. After these three industries, most other industries have the same lost work time costs except for health services. The percent differences in expected indemnity costs is given in the right-hand column. For example, agricultural firms in workers' compensation have "indemnity/lost work time" costs that are 31.8 percent higher than firms that have opted out. Since fatality rates are virtually the same in the workers' compensation and tort sectors, this may be the result of fewer reported "chronic," long-tailed claims among the employees of tort (nonsubscribing) firms. Similar comparisons can be made for other industries. It is especially interesting to note that when the results are decomposed to the two-digit SIC level, cost differentials between the tort and workers' compensation employers virtually disappear (see the last 12 rows of Table 7).

But since nonsubscribing firms are subject to tort actions by their employees, doesn't the risk of litigation substantially increase the expected costs of those opting out of workers' compensation? The general perception (of the many individuals with which I have communicated) is that the *ex ante* (potential) risk is greater for those opting out. Anecdotal evidence indicates that, because of this risk, many larger nonsubscribing firms have adopted safety measures that have substantially reduced the real level of job risk at their firms. Perhaps this explains why many nonsubscribers have lower fatality rates than workers' compensation firms in those same industries. But whatever the differences in safety programs, or differences in *ex ante* legal risks they face, the actual legal expenditures for subscribing and nonsubscribing firms appear to be about the same (see Table 8).

Table 7
Relative Indemnity Cost Differentials

	Relative Indemnity Cost Index	
	(Nonsubscriber/Subscriber)	Percent Difference
<i>One-Digit SIC Industries</i>		
Agriculture	0.727	31.8
Mining/Construction	1.239	-21.5
Nondurable Manufacturing	1.039	-3.8
Durable Manufacturing	1.091	-8.7
Transportation	1.723	-54.4
Trade	0.737	30.5
Finance	2.026	-70.6
Other Services	0.816	20.3
Health Services	2.461	-90.1
Tax Exempt	0.097	232.8
<i>Two-Digit SIC Industries</i>		
Food Manufacturing	1.207	-18.8
Textiles	0.589	52.9
Fabri. Metal	0.971	0.30
Trucking	1.185	17.0
Nondurable Wholesale	1.287	-25.2
Food Stores	0.185	168.8
Auto Dealers/Service Stations	1.396	-33.4
Restaurants	0.933	7.0
Hotels	1.039	-3.8
Personal Services	0.994	0.6
Business Services	0.856	15.6
Medical Services	2.229	-80.1

Note: The relative indemnity cost index is the average cost per employee under the two systems if the workers are paid the same weekly indemnity for lost work time.

The data shown in Table 8 present per employee costs of legal activity, including the amount of money paid by firms for legal services and penalties imposed by administrative agencies. Although there are no legal cost data on the regular claims, a Detailed Claim Information (DCI) file made available through the Texas Department of Insurance for all claims whose total costs exceed \$5,000 did provide information paid by employers for legal services. The DCI Data column contains the average legal costs per employee (not per claimant) as reported under the following categories: employers' legal expenses paid to date, claimant legal expenses paid (by the employer) to date, and penalties payable to either the claimant or an administrative agency. (Fees for expert witnesses are not included in these totals but would increase the average expenditures by another 10 percent). On an employee basis, these expenditures are not very large (but do not represent the value of company employees' time spent in trial preparation, nor do they represent the plaintiffs' preparation costs).

Table 8
Work Injury Legal Expenses Per Employee by Industry

	Subscribing Firms		Nonsubscribing Firms
	DCI Data (1992-1993)	Texas Legal Reports (1993-1994)	Texas Legal Reports (1993-1994)
Agriculture	\$7.38	\$0.00	\$0.00
Mining/Construction	\$0.63	\$14.20	\$11.38
Manufacturing	\$0.38	\$16.54	\$45.56
Transportation	\$0.14	\$0.93	\$6.68
Trade	\$0.34	\$0.35	\$4.46
Finance	\$0.13	\$0.00	\$0.00
Other Services	\$0.21	\$3.21	\$3.81
Health Services	\$0.24	\$1.65	\$2.65
Overall	\$0.43	\$9.02	\$9.20

Note: The legal data from the Texas Department of Insurance Detailed Claim Information (DCI Data) include employers' legal expense paid to date, claimant legal expense paid to date, and penalties paid to date. The Texas Legal Reports data come from various issues of *East Texas Trial Reports*, *Houston Trial Reports*, *North Texas Reports*, and *Soele's Trial Report*. The overall industry data include cases with incomplete or missing SIC information (data which obviously are not included in the industry averages above). Because there is much better information on SIC codes for nonsubscribers, comparative industry-by-industry analyses will unduly favor the subscriber data, but the overall data are free of this bias. I am grateful to Steve Bent for making the Texas Legal Reports data available and to the TWCC for making the DCI data available.

Much more significant than these DCI-type, firm costs are the legal awards (reported in the middle and right-hand columns) from various Texas legal reporting services for 1993 and 1994 cases. The middle column reports the settlements to plaintiffs for workers' compensation claims (principally, whether the worker's injury "arose out of, and in the course of" employment or whether the worker was wrongfully terminated because of a workers' compensation claim), and the right-hand column represents tort settlements to injured workers for nonsubscribing employees. While the data in these two columns obviously have their shortcomings,²⁸ they are the only data available that are reported on a comparable basis.

²⁸ They do not necessarily include threatened legal actions that were never scheduled for trial, for example. The settlement amounts for both subscribers and nonsubscribers are calculated on the assumption that the best possible outcome for the plaintiff was obtained, using the following algorithm. If a settlement was indicated with a settlement amount, then this was taken as the value of the legal settlement amount costs. If there is no settlement amount listed, then the largest of the following was assumed to be the settlement amount: the pretrial demand, the pretrial offer, the trial demand, the trial offer.

If there is no settlement indicated, but a verdict in favor of the plaintiff is recorded, then the legal settlement is the indicated settlement amount. If no settlement amount is given, then the legal settlement is the larger of the trial offer or trial demand if either one of these is indicated. If there is no trial offer or trial demand recorded, then the legal settlement is set equal to the larger of the pretrial offer or pretrial demand. If there is no settlement indicated, but a verdict in favor of the defendant is recorded, the legal settlement is equal to the settlement amount where a settlement amount was indicated. If no settlement amount is indicated, then the legal settlement is set equal to zero.

The last row indicates that the "settlement" costs vary little between the two sectors and that the other legal (DCI-type costs) may not be very great on a per capita basis.

CONCLUSION

In industries with roughly comparable levels of safety, the legal and indemnity costs of injuries appear to be about the same for subscriber and nonsubscriber firms. This may explain why, despite the improved loss experience in workers' compensation since Senate Bill 1 was passed, the number of employees covered by nonsubscribing firms continues to remain at about 20 percent. Indeed, the fact that the fraction opting out has remained relatively constant suggests that there is a market for different workplace injury options. Not everyone with the opportunity of opting out is choosing to do so in Texas; one policy does not seem to fit all. Why some firms choose to opt out and others do not is an important empirical issue that undoubtedly will be addressed in future research. But, as indicated in the introduction to this article, analyzing the "opt-out" choice itself is beyond the scope of this analysis.

The patterns of reported injury behavior observed in the data are consistent with the moral hazard incentives discussed for each system and explain why the employees of tort firms report more frequent but less severe injuries. The lower injury rate in workers' compensation firms is partially due to Texas' seven-day workers' compensation waiting period that effectively lowers real indemnity benefits in the initial phase of an injury. Claims reporting moral hazard effects also explain why workers' compensation firms have higher average durations of claims and report relatively more sprains and strains. A lack of guaranteed coverage for longer-term, chronic conditions and more control over medical providers in the nonsubscribing sector considerably lessens both employee and provider incentives to report chronic, longer-termed injury conditions.

APPENDIX

Table A1
Data Means by Sample Exclusion Criterion

	Male	Age	Indemnity Claim
<i>Panel A: Subscribing Firms</i>			
<i>Full Sample</i>			
Mean	0.525	36.19	0.446
Standard Deviation	0.50	11.41	0.50
Number of Observations	896,355	656,285	806,699
<i>Exclusion: Indemnity Type</i>			
Mean	0.530	36.09	0.446
Standard Deviation	0.50	11.40	0.50
Number of Observations	806,699	596,674	806,699
<i>Exclusion: Indemnity Type, SIC</i>			
Mean	0.627	36.98	0.428
Standard Deviation	0.48	11.59	0.50
Number of Observations	170,353	165,241	170,353
<i>Exclusion: Indemnity Type, SIC, Nature of Injury</i>			
Mean	0.640	37.21	0.581
Standard Deviation	0.48	0.22	0.50
Number of Observations	88,399	85,804	88,399
<i>Panel B: Nonsubscribing Firms</i>			
<i>Full Sample</i>			
Mean	0.572	26.81	0.368
Standard Deviation	0.505	16.83	0.46
Number of Observations	49,114	49,114	40,463
<i>Exclusion: Indemnity Type</i>			
Mean	0.567	26.91	0.368
Standard Deviation	0.50	16.89	0.46
Number of Observations	40,463	40,463	40,463
<i>Exclusion: Indemnity Type, SIC</i>			
Mean	0.567	26.91	0.368
Standard Deviation	0.50	16.89	0.46
Number of Observations	40,463	40,463	40,463
<i>Exclusion: Indemnity Type, SIC, Nature of Injury</i>			
Mean	0.543	27.46	0.378
Standard Deviation	0.50	17.08	0.46
Number of Observations	16,559	16,559	16,559

MAXIMUM LIKELIHOOD ESTIMATES OF THE MEAN DURATION OF NONSUBSCRIBER CLAIMS AND THE DETERMINANTS OF DURATION

As indicated in the text, the only information available for the nonsubscribers is whether the individuals' lost work time was from two to seven days or eight or more days. The estimates for mean duration in Table 4, based on these aggregated groupings, is based on maximum likelihood estimates for a truncated exponential distribution (the TWCC-7 forms ask only if the claims were more than one day but less than seven, or eight or more days, leaving unknown the number of claims of exactly one day in length). Let N_1 be the number in the two to seven days category, N_2 be the number in the eight or more days category, and assume that time is measured to the beginning of each period (the beginning of the second day to the beginning of the eighth day, and the beginning of the eighth day onward). Then the likelihood equation becomes

$$MLE = \frac{[(1 - \exp(-\frac{8}{b})) - (1 - \exp(-\frac{2}{b}))]^{N_1} [(1 - \exp(-\frac{\infty}{b})) - (1 - \exp(-\frac{8}{b}))]^{N_2}}{1 - (1 - \exp(-\frac{2}{b}))}$$

which can be simplified as

$$MLE = \left(\frac{[(\exp(-\frac{2}{b})) - (\exp(-\frac{8}{b}))]}{\exp(-\frac{2}{b})} \right)^{N_1} \left(\frac{\exp(-\frac{8}{b})}{\exp(-\frac{2}{b})} \right)^{N_2},$$

where b is the estimated mean of the duration of time out of work. The estimated values of b for each industry and injury type combination is given in Table 4. Table 1 also presents actual sample average injury type for subscribing firms for comparison with the maximum likelihood estimates.

In order to estimate the determinants of claim duration, employ individual data on lost time from work, and to use a more flexible distributional form, individual models of duration are employed assuming that claims are Weibull distributed rather than exponentially distributed. These models are more complex than the exponential model in two ways: a shape parameter, a , is added to the model to make it more flexible (the distribution is exponential when $a = 1$), and the mean parameter b is made a function of claimant and claim characteristics. The maximum likelihood estimate for the nonsubscriber model is

$$MLE = \left(\frac{[(\exp(-(\frac{2}{b})^a)) - (\exp(-(\frac{8}{b})^a))]}{\exp(-(\frac{2}{b})^a)} \right)^{N_1} \left(\frac{\exp(-(\frac{8}{b})^a)}{\exp(-(\frac{2}{b})^a)} \right)^{N_2},$$

where $b = \exp(X\beta)$,

X = a vector of claimant traits, and

β = a vector of estimated coefficients.

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