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Opting out of workers' compensation: Non-subscription in Texas and its effects

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Abstract

Texas is the only state that does not mandate that employers carry workers' compensation (WC) insurance coverage. In place of traditional WC, companies can choose to offer alternative "non-subscription" disability plans to workers. Little large-scale empirical research has studied the consequences of switching from traditional WC to non-subscription plans. We use a difference-in-differences estimator along with a novel machine learning approach to compare effects of switching to non-subscription plans for employees in Texas versus contemporaneously measured non-Texas-based employees for 25 large companies. Our results indicate that total medical payments dropped by roughly 40% from switching to non-subscription plans, consisting of reductions in hospital spending, physician spending, and other medical spending. Similarly, indemnity payments dropped by 70% and number of reported lost days dropped by 80%. Accumulating all sources of spending, we find that total expense associated with workplace injury fell by approximately 46% after switching to the non-subscription program.

Keywords Workers' compensation insurance · Non-subscription · Difference-in-differences · Triple differences · Machine learning · PDS-LASSO

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1 Introduction

Our research seeks to learn about the effects of switching from a traditionally organized workers' compensation (WC) program to a non-subscription program in the state of Texas. Texas is the only state that allows almost all private sector employers to forego WC insurance coverage for their workers.[1] Other states, including Oklahoma, South Carolina, and Tennessee have considered allowing opt-out. Oklahoma passed a law in 2013 that allowed firms to opt out of workers' compensation, but it was ruled unconstitutional by the state Supreme Court in 2016. In recent years more employers, particularly large self-insured employers, are switching to a non-subscription model for their Texas-based operations. We employ a quasi-experimental design to examine the effects of switching from traditional WC to a non-subscription program in Texas.

In particular, we compare before and after effects of switching to non-subscription for employees in Texas to contemporaneously measured before and after differences for non-Texas-based employees of the same companies. We study large self-insured companies operating the same business in multiple states in the US; hence the non-Texas operations represent the control sites for the Texas treatment sites. The resulting difference-in-differences estimation technique allows us to control for any companywide factors that might be confounded with switching to non-subscription in Texas. The analysis also controls for a variety of other factors including injury characteristics, employment characteristics, industry, and individual characteristics such as gender, age, number of dependents, and marital status. Outcomes include number of claims reported, medical expenditures, indemnity payments, days out of work, likelihood of having permanent disability, likelihood of claim denial, and likelihood of litigation.

Our data include 25 companies switching to non-subscribers (hereafter, switchers) between the years 2004 and 2016, yielding 846,376 injury incidents. Because switching to a non-subscription program may systematically change the composition of injuries reported, the claim-level estimates conditional on the injuries reported are likely to be biased. To overcome the sample selection problem, we aggregate the data to company-state-year level. Regression findings suggest that switching to the non-subscription plan makes medical and indemnity payments fall substantially while return to work increases. Claim denial rates increase, but litigation rates are unchanged.

2 Background

WC insurance is a state system of disability payments for workers injured on the job. Although the details of the programs differ across the 50 states, the District of Columbia, and the various U.S. territories, the general crux of each program is the same. Regardless of fault, an employer must pay an injured worker's medical bills and

[1] The lone exception is for private employers engaged in public sector construction projects who must provide WC insurance coverage for all employed workers (Texas Labor Code § 406.096). The state does not permit public sector employers from opting out of the WC program (Texas Labor Code §406.002).

a portion of his or her lost labor income. In return for the no-fault coverage, workers give up their right to sue their employer to recover all of their lost income and any compensation for pain and suffering. As the exclusive remedy, WC shields employers from potentially expensive damage awards for negligence.

State WC laws generally dictate that all employers must provide insurance coverage to their workers by either contracting with a private insurance company or a state agency or through self-insurance. Texas is the only state that allows almost all private-sector employers to opt out of the WC program (Texas Department of Insurance: Division of Workers' Compensation 2016). By opting out of the system, employers need not pay an injured worker's medical expenses or any indemnity payments for lost income unless the worker can prove in court that the employer was at fault. Workers can prevail if they can demonstrate that their injury was the result of their employer's failure to use ordinary care in providing a safe workplace. A worker can show that the workplace was unsafe by providing evidence that the employer failed to hire enough workers to complete the project safely, train or supervise workers adequately, warn workers of hazards, provide safe or suitable tools, inspect equipment for defects, or provide proper and complete safety training (Taylor 2015). The Texas WC Act prevents employers from raising the three common law defenses of contributory negligence, assumption of risk, and negligence by a fellow servant, increasing the likelihood that a worker can demonstrate employer liability (Texas Labor Code §406.033). In 2016, 20% of surveyed employers in Texas purchasing WC insurance gave as their primary reason for staying in the system concern over lawsuits (Texas Department of Insurance: Workers' Compensation Research and Evaluation Group 2016).

WC insurance in Texas fully pays medical expenses resulting from a workplace injury and illness and replaces 70% of an injured worker's lost weekly wage for up to 104 weeks, subject to a state-specified cap. The cap increased from $537 in 2004 to $895 in 2016, in step with the state's average wage. To receive income benefits the injury must prevent the worker from returning to work for at least 8 days. No income benefit is received for the first week of lost work unless the worker is out of work for more than 14 days. If not fully recovered in the 104-week period, injured workers may apply for impairment income benefits, supplemental income benefits, or, for extremely serious injuries, lifetime income benefits. WC insurance also provides income support for the families of fatally injured workers (Texas Department of Insurance 2018).

Non-subscribing employers in Texas can, if they choose, offer injured workers disability benefits in a manner similar to those offered through the WC program. Many employers, particularly larger employers, choose to establish a private, no-fault disability program that pays injured workers medical expenses and at least a portion of lost wages. In 2016, 65% of non-subscribing firms with 100 or more employees offered their workers occupational disability benefits resulting in 87% of employees in large non-subscribing firms being covered by such plans (Texas Department of Insurance: Workers' Compensation Research and Evaluation Group 2016). Private plans can be more generous than WC insurance, at least initially, but most private plans limit the duration of payments for medical expenses and lost income potentially making them less generous for workers with permanent partial or permanent total disabilities (Morantz 2010). On the other hand, the ability to recover full damages through a negligence lawsuit and employer payments falling outside of the formal disability plan to avoid such lawsuits, may make a worker's monetary recovery greater through non-subscription.

Subject to the Employee Retirement Income Security Act (ERISA) requirements regarding the administration of claims, non-subscribing employers have complete discretion in the design of a private disability plan, including directing where a worker can receive medical treatment.[2] The two primary reasons given by large non-subscribing employers for opting out of the WC system is the belief that they can do a better job at providing appropriate medical and wage loss benefits to injured workers and at controlling medical costs (Texas Department of Insurance: Workers' Compensation Research and Evaluation Group 2016). Still, the flexibility of a private plan allows employers to deny coverage for injuries that would be covered with WC insurance, thereby lowering disability expenses. With limited exceptions, workers whose injuries or illnesses arose "out of and in the course and scope of employment" are entitled to WC medical and indemnity benefits regardless of fault (Texas Labor Code §406.031).[3] Private plans can be far more restrictive. Employers can limit coverage to injuries whose "major producing cause" is the workplace or injuries resulting "directly and solely" from an accident (Robinson 2016). Many private plans exclude diseases from airborne contaminants not commonly found in the workplace, harms caused by asbestos, degeneration (such as carpel tunnel syndrome) caused by poor posture or long-term use of a device, generalized musculoskeletal aches and pains, injuries caused by an accident that did not occur by chance or from an unknown cause, or injuries resulting from a failure to comply with safety policies or from a failure to request assistance (Morantz 2016). Additionally, coverage can be terminated for a variety of causes including the failure of the worker to submit to required medical tests, receive necessary pre-approvals for medical procedures, and follow recommended medical treatments (Morantz 2016).

The creation of a private disability plan does not shield an employer from possible liability suits for negligence. Many large non-subscribing employers attempt to reduce litigation risk by having an injury benefit plan and containing litigation expenses by requiring mandatory arbitration of negligence liability claims to resolve disputes over coverage (Morantz 2010).

In 2004, 38% of the employers in Texas opted out of the WC system and 23% of Texas workers were employed by these firms. In 2016, the fraction of non-subscribing employers had dropped to 22% and the fraction of workers to 18%. Texas reformed its WC program in 2005. The reforms allowed employers to direct injured workers to a certified WC health care network or if unavailable or impractical to contract directly with health care providers

[2] ERISA applies to all employee welfare benefit plans, including private disability plans established by firms opting out of the WC system. To satisfy ERISA requirements companies with private plans must generate a document detailing the operation and the administration of the plan and then provide each covered employee with a summary of the plan description, updates on material modifications of the plan, and any plan documents upon request. The plan administrator and other plan fiduciaries must act in the best interest of covered employees and beneficiaries. Every benefit plan must establish a reasonable set of procedures for administrating the plan. These procedures must result in workers receiving a full and fair review of their claims and benefit awards consistent with the plan document and with similarly situated claimants. Workers denied benefits have the right to an internal appeal and if not resolved, an external appeal via state or federal court. It should be noted that ERISA explicitly excludes all benefit plans established to comply solely with applicable state WC laws (Minick 2015).

[3] Non-covered injuries include injuries occurring while a worker is intoxicated, injuries resulting from a worker's own actions to injure him or herself or unlawfully injure someone else, injuries arising from the actions of someone else who intended to harm the worker for personal reasons, injuries arising from an act of God, and injuries resulting from the worker's horseplay (Texas Labor Code §406.03).

to treat injured workers. The reforms also established evidence-based treatment guidelines for medical care, limits on acceptable medications, and new administrative procedures for resolving disputes. The reduction in the cost of claims lowered WC insurance premiums by about 56% since 2003. The price reduction enticed many more small employers to purchase WC insurance resulting in the large decline in the fraction of non-subscribing employers and modest reduction in the fraction of employees working in these establishments. The fraction of large companies (500 or more employees) electing to opt out of WC system has barely budged, falling from 20% in 2004 to 19% in 2016 (Texas Department of Insurance: Division of Workers' Compensation 2016).

There is little research studying the non-subscription phenomenon in Texas. Morantz (2010) provides vital qualitative information based on a telephone survey of non-subscriber firms in Texas. Importantly, she focuses on the motivation for large, national firms. She finds that the primary motivation for opting out of WC was to achieve cost savings, control medical providers, and control program benefits. Virtually all firms in the survey reported cost savings, greater control over medical providers, greater control over program benefits, improved quality of medical care, faster return to work, and access to better doctors. Some respondents reported litigation trouble in the wake of opting out.

An earlier study by Butler (1996) used aggregate company-level data on fatality rates, non-fatal claims rates, injury durations, and rates of chronic injuries between traditional WC firms and non-subscriber firms. Butler found that fatal injury rates did not differ between non-subscribers and other firms, suggesting that the safety environments between companies were similar. He did find higher levels of non-fatal injury rates in non-subscriber firms, which he attributed to moral hazard on the part of workers given the first-day wage replacement benefit common in non-subscription plans (versus the common seven-day waiting period in the traditional WC system).

A more recent study by Morantz (2016) found disability costs per worker hour to be 44% lower in Texas for 15 large multi-state employers who replaced WC coverage with a private disability plan. Costs per worker hour dropped for the employers in Texas because they had fewer more serious claims for lost wages and the cost per claim was lower, both for medical and wage-replacement expenses. All types of injuries fell for Texas non-subscribers and, not surprisingly, non-traumatic injuries dropped more dramatically than traumatic injuries. Private plans exclude many types of non-traumatic injuries, so the large drop in claims for such injuries is to be expected. But even restricting the claims data to non-traumatic injuries covered by all of the 15 private plans and WC insurance, non-traumatic injuries fell more than traumatic injuries. Texas non-subscribers also experienced a large drop in severe, traumatic injuries. As the injuries are unlikely to be subject to a reporting bias, the decrease is consistent with a real improvement in safety. Unfortunately, the data are not rich enough to exclude the possibility that the reduction even in severe, traumatic injuries is driven by non-subscribing firms more aggressively screening and denying claims.

In the final study we mention, Cabral et al. (2018) estimated that a 10% increase in the premium results in a 3% decline in WC coverage in Texas using the variation in insurance premiums resulting from regulatory updates. However, the demand estimate shows that adverse selection among firms opting out of WC in Texas is not evident, suggesting that adverse selection is not the driver for mandatory coverage in the WC market.

3 Conceptual framework

The basic framework guiding our empirical work is the standard approach that assumes workers choose the level of consumption spending and workplace safety to maximize expected utility subject to an overall budget constraint at the same time employers choose the level of inputs to maximize expected profit, where workplace safety is one of the inputs (see for instance, Viscusi 1979; Moore and Viscusi 1990; Kniesner and Leeth 1989, 1995, 2014; Ruser and Butler 2010; Butler and Gardner 2011). From the worker perspective, the basic model predicts that increases in disability payments reduce a worker's expected loss from injury, all else equal, and encourage the worker to take greater risk. Butler and Worrall (1991) refer to such moral hazard as risk taking moral hazard (or ex ante moral hazard). The impact of non-subscription on risk taking moral hazard depends on whether non-subscription raises or lowers workers' expected disability benefits if injured. Confounding the theoretical impact of non-subscription on workplace injuries is the change in firm incentives to encourage greater workplace safety. From the employer perspective, firms increase their use of labor and capital until the expected marginal revenue product of each input equals its expected marginal cost. The model predicts that firms reduce workplace hazards until the marginal benefit of greater safety, which includes higher output from fewer work disruptions, lower wages, reduced disability costs, and lower government fines for workplace hazards, equals the marginal cost of supplying greater safety.[4]

With such a model as a backdrop, we can predict that the movement to non-subscriber status would:

1. *Have an uncertain effect on worker injuries*. For relatively minor injuries disability benefits are higher for workers employed by non-subscribing firms than workers employed by firms remaining in the WC system, but for more major injuries benefits are more likely higher for workers employed by firms remaining in the WC system than for workers employed by non-subscribers. Higher disability benefits reduce expected losses from injury and may encourage workers to take greater risks. But in the other direction, higher benefits encourage firms to expand their safety efforts. Non-subscribing firms have the additional incentive to engage in new safety efforts because opting out of the WC system opens up these firms to potentially costly liability awards for negligence. Considering the potentially conflicting desires of workers and firms, the overall impact on the true level of safety is ambiguous.
2. *Increase reported short-term injuries*. Empirical studies examining the impact of lowering the waiting period to collect WC indemnity payments universally find shorter waiting periods associated with increases in the frequency of reported non-fatal workplace injuries (Chelius 1982; Butler and Worrall 1983; Krueger 1990). The shortening of the waiting period to receive indemnity payments increases the

[4] Workplace safety programs increase output by diminishing the disruptive effects of injuries and by increasing the stability of the workforce (Viscusi 1979). In the other direction, programs such as slowing the pace of the assembly line or installing cumbersome machine guards can interfere with the work process and decrease output. On net, which effect dominates is an unresolved empirical question. For purposes of discussion, we assume that safety equipment is a productive factor. None of the conclusions we present change if safety equipment reduces output.

income support for temporary total injuries and raises the expected utility of applying for benefits. The requirement that injuries must be reported by end of shift or within 24 hours (versus 30 days with WC) will also raise the number of reported injuries and the number of injuries resulting in no recorded medical or indemnity expense.

3. *Reduce applications for permanent partial and permanent total disability benefits and benefits for workplace illnesses and non-traumatic injuries*. Non-subscriber status makes it less likely that workers will receive these types of disability payments reducing the expected utility from making such applications, particularly for hard to verify injuries.
4. *Decrease injury duration*. More active injury management and discretion over provider utilization will lower total work loss due to injury. The need for employer approval should reduce medical providers' incentives to be overly cautious in recommending a return to work or prescribing unneeded treatments, which will also lower the time away from work, all else equal. Proponents of non-subscription argue that the requirement that workers report and seek medical treatment quickly after injury from an approved set of expert medical providers, many of whom may be unavailable to injured workers employed by WC subscribing firms, results in better medical outcomes and a more rapid return to work (Minick 2015).
5. *Lower indemnity and medical expenses*. With lower spending on medical services and decreased injury duration, expenses will drop. Likewise, the changes in receiving compensation for permanent partial and permanent total disabilities and the need to frequent an approved list of medical providers will also reduce total claim expenses.
6. *Have an uncertain impact on litigation*. Most large non-subscribing employers have disability plans that cover lost wages and medical expenses for workers injured on the job regardless of fault for up to a few years, much like the coverage offered by WC insurance for temporary total disabilities. The divergence between the two systems occurs with more serious injuries. Under a private plan, to collect damages a worker may need to show in a court of law that the injury arose in the course of employment and that the employer was negligent, whereas under WC a worker only needs to show in an administrative proceeding that the injury arose in the course of employment. Although court actions are more expensive than administrative proceedings, the expense of pursuing negligence suits will discourage many workers from this course of action. Moreover, most large non-subscribing employers limit litigation expenses by requiring that their workers settle negligence disputes through mandatory arbitration (Morantz 2010).[5]
7. *Have an uncertain impact on denied claims*. Private plans have greater restrictions on the types of injuries and illnesses covered and additional barriers for workers to hurdle to receive and continue to receive coverage. Moving to a private disability system may make it easier for employers to deny worker claims for disability payments, causing the denial rate to rise, all else equal. But the reduced chance of receiving payment for an exaggerated claim lowers the expected benefit of

[5] Litigation may also be precluded if the employer provides a monetary settlement to the injured worker before litigation or arbitration commences.

applying in questionable cases. Depending on the strength of the two effects, the number of denied claims could rise, fall, or remain constant.

4 Data

The data in our study were obtained from a nationwide third-party administrator that manages workplace injury claims for large, self-insured companies. For each claim, we observe information on the individual filing the claim (gender, marital status, age, and number of dependents, and importantly the state where the worker was employed), the company (encrypted company code, two-digit Standard Industrial Classification, SIC), the claim type (incident report, medical expense-only, indemnity claim, and death claim), the claim status (accepted, denied, opened, closed, and litigated), the injury (nature of the injury and number of lost days), the expenses (indemnity incurred and medical expense incurred), the individual's employment status (full-time/part-time employee status, average pre-injury weekly wage, time they have worked in a company), and the relevant dates (date of incident, date injury reported to the firm, date claim opened/closed, and date claimant return to work).

4.1 Sample construction

Table 1 illustrates the steps we take to produce the analytical sample to estimate the impact of companies switching to non-subscription program (hereafter, switchers). Our initial sample contains 6,397,967 workplace injuries occurring from 2004 to 2016 across the 50 states. The claimants who are above age 64 are excluded from the sample because Medicare is available once workers reach 65 and they may use Medicare in lieu of WC if injured. We exclude incident reports because they are not claims. We further eliminate claims that incur negative expenses, which possibly were recorded in error. Together our exclusions represent 13% of the sample.

In the analyses, we would like to compare workers with similar wage earning ability so we control for worker's pre-injury weekly wage. Because 36% of claimants have missing pre-injury weekly wage, we impute the missing weekly wage value. The missing status is not correlated with the claimants' demographic characteristics.[6] We impute the missing weekly wage using workers whose pre-injury weekly wages are available. Specifically, we calculate the average weekly wages for workers with wage information available that share similar characteristics with workers with missing wage data, and use them as proxies for the missing wages. Similar characteristics are defined as workers sharing the same industry, same occupation, same gender, and same employment status; with age differences of 5 years or less, differences in length of time at work of 3 years or less. After imputation, observations with missing weekly wages are reduced down to 10% of the sample. We exclude observations with missing weekly wages and with values that are below $10 or above $10,000 because we suspect wages outside of this range are recorded in error.

[6] We regress the missing status on claimants' demographic characteristics. The coefficients on demographic characteristics are not statistically significant.

Table 1 Sample section

Steps	Number of Observations	Comments
Step 1: Claims across 50 states, 2004–2016	6,397,967	Initial sample
Step 2: Keep claimants who are between age 16–64, and have served in a firm for at most 49 years	5,835,673	Claimants who are older than 64 are eligible for Medicare, which they may use in lieu of WC.
Step 3: Keep four types of claims: medical only, temporary disability, permanent disability, death	5,581,827	Drop claims belonging to incident report because incident report is not a claim yet.
Step 4: Keep claims that incur zero or positive expenses	5,578,806	Drop claims with negative expenses potentially due to measurement error.
Step 5: Impute missing pre-injury weekly wage value and keep the weekly wage between $10–$10,000	4,977,805	36% of weekly wage values are missing. After imputation, 10% of weekly wage values are missing.
Step 6: Impute number of lost days for claims that incur positive indemnity but are recorded as having no lost days. Exclude claims that incur more than 365 lost days and claims that take longer than 90 days to report to employers.	4,627,065	Impute 7% of the values. Claims that take longer than 90 days to report might be recorded in error.
Step 7: Keep claims from the 25 switchers	846,376	
Step 8: Aggregate up to company-state-year level (DID method)	566	
Step 9: Aggregate up to company-state-year level (DDD method)	10,240	

There are 7 % of claims in our sample that incur positive indemnity but with no lost days. Typically under WC, claimants who are totally or partially disabled and unable to work have a waiting period of 3 to 7 days before receiving indemnity (Social Security Office of Retirement and Disability Policy 2015). Therefore, we assume the claims with positive indemnity but with no lost days are recorded in error. To avoid dropping observations, we impute the number of lost days for claims with (apparently) missing work-loss, defined as days between the date of injury and the date that workers return to work.[7] We then exclude the claims that incur more than 365 lost days to avoid censoring and potential measurement error. Moreover, if injured, workers are required to report their work-related injuries to their employers within a pre-specified period, ranging from 30 days (New York State) to 90 days (South Carolina). Therefore, we assume the claims that take more than 90 days to report to employers are recorded in error and exclude such claims. In total the sample size drops down to 4,656,894, which is 73% of the initial sample.

We estimate the effects of switching to a non-subscription program using difference-in-differences (DID) and triple-difference (DDD) methods. There are 1218 companies in the sample, 25 of which are observed to switch from a traditional workers' compensation program for their Texas-based operations to the non-subscription

[7] The calculation method is verified by the company from which the data were obtained.

program managed by the third-party administrator from which we obtained our data; a traditional workers' compensation program remains in effect at each company's non-Texas-based operations. We restrict the sample for the DID analysis to the 25 switchers, which consists of 846,736 workplace injury claims from 2004 to 2016 across the 50 states. To control for any Texas-specific shocks that are potentially correlated with switching, we perform a DDD analysis, using the rest of companies that do not switch to the non-subscription program (hereafter, "never switchers") as an additional control group.

As noted earlier, we are concerned that switching to the non-subscription program may systematically change the composition of injuries reported. Given the significantly shorter injury reporting window under non-subscription in Texas, workers may be more likely to file claims leading to a greater number of less severe injuries in the sample. Thus, *claim-level* estimates conditional on the injury reports would be biased. Instead, to avoid dividing by a potentially endogenous denominator, we sum the values of our outcome variables to the company-state-year level.[8] Performing analysis at the company-state-year level avoids the sample selection issue because we are able to control for injury changes within a company. The number of observations at company-state-year level is 566 for DID analysis, and 10,240 for DDD analysis.

4.2 Outcomes

The outcomes we examine are the number of claims/injuries (measured several ways), the medical payments incurred, the indemnity payments incurred, settlement amount, litigation expense, the number of lost days incurred, the number of permanent disability claims, the number of claims denied, and the number of litigated claims. Finally, we sum all spending into a total employer spending value. We now elaborate on our outcomes measures.

1. Number of injury claims: The total number of injuries reported during a calendar year. We use the date of the incident to identify which calendar year in which the injuries occurred. We distinguish between denied and non-denied claims as well as claims for which no medical (or indemnity) payment was incurred and claims with some positive spending. We also attempt to distinguish between unambiguous types of injuries that are unlikely to involve potential reporting biases.
2. Total medical spending incurred: We use four different outcomes to measure the medical spending incurred: total medical spending, which consists of hospital spending, physician spending, and other medical spending including fees that do not belong to the categories above, such as utilization review fee.
3. Total indemnity incurred: The cash benefit incurred due to the injury to compensate for lost wages. In our sample, it is only possible for injuries under indemnity claims to have positive amount of indemnity.
4. Number of lost days: The number of days missed from work due to the injury. The definition of what constitutes a lost day varies depending on the individual state. In general, the number of lost days incurred under indemnity claims are much higher than the number of lost days under medical expense-only claims.

[8] State refers to Texas versus all other states. This is the case throughout the analysis.

5. Number of permanent disability claims: Permanent disabilities are rare, but they account for a much larger share of the total WC benefit paid. The number of permanent disability claims has important implications on overall spending. Moreover, since permanent disability is more serious than other types of injury, looking at permanent disability claims sheds light on the impact of switching to a non-subscriber program on the overall safety in the workplace.
6. Litigated claims: The elimination of the no-fault nature of traditional workers' compensation introduces the potential for dispute resolution by litigation for injured workers. We are interested in knowing whether non-subscribers have more claims litigated. We also sum total litigation expense and settlement amount.

4.3 Summary statistics

Summary statistics appear in Tables 2, 3, 4 and 5 and are organized by outcome variables, injury characteristics, employment characteristics, claimant and claim characteristics. The claims are categorized into four groups: claims by workers outside of Texas before switching, claims by workers in Texas before switching, claims by workers outside of Texas after switching, and claims by workers in Texas after switching. Note that the non-Texas-based observations maintain a traditional WC program and thus serve as a comparison group. All the summary statistics are aggregated to the company level, so there are 25 observations in each group.

Table 2 displays summary statistics on the outcome variables. Compared to the pre-switching period, the number of claims increased by 86% among switchers in the post-switch period relative to 36% among their non-Texas-based operations. During the post-switching period, the non-Texas-based operations tripled the number of denied claims relative to the pre-switching period, while the switchers increased the number of denied claims by five times. Except for the lump sum settlement amount, there are significant reductions in expense outcomes among the switchers during the post-switching period compared to the pre-switching period, while their non-Texas-based operations experienced minor decreases to modest increases. The lump sum settlement that switchers pay to settle a claim increased from a mean of $3 in the pre-switching period to $375 in the post-switching period. Switchers also experienced a significant reduction in work loss in the post-switching period, while their non-Texas-operations had a modest increase in work loss. The number of permanent disability claims remained stable in both periods among the switchers, and it increased by just under 50% among their non-Texas-based operations. Lastly, the switchers in general had fewer litigated claims than their non-Texas-based operations, although both groups had more litigated claims during the post-switching period compare to the pre-switching period.

Table 3 displays the summary statistics on the nature of injury. Soft tissue injuries (strain/sprain/tear) are the most frequent (40% of all injuries), and easy-to-diagnose injuries such as contusion and laceration are the second most frequent across all groups (27%). The proportion of both types of injuries remained stable during the entire study period for both groups.

Table 4 shows summary statistics on employment characteristics. Workers from both groups shared similar patterns in employment status during the entire study period, with

Table 2 Summary statistics on outcomes

Variables	All	Pre-Switching		Post-Switching	
	mean/sd	Non-TX mean/sd	TX mean/sd	Non-TX mean/sd	TX mean/sd
Number of Claims	2898.5	2124.7	210.0	2886.0	390.8
	(5105.5)	(4425.8)	(353.7)	(4421.9)	(712.6)
Number of Denied Claims	240.9	93.88	11.09	292.0	67.35
	(458.9)	(161.5)	(16.34)	(517.6)	(107.7)
Total Medical Spending	3001.1	2910.7	2692.4	3889.5	1596.6
	(1195.3)	(1340.2)	(1776.5)	(2077.8)	(1033.9)
Hospital Spending	431.9	472.8	408.9	449.9	271.3
	(209.6)	(222.9)	(377.4)	(295.5)	(328.6)
Physician Spending	970.5	952.5	1263.8	1138.2	672.6
	(364.5)	(450.4)	(1028.6)	(532.5)	(377.4)
Other Medical Spending	1175.8	1236.9	973.2	1411.3	558.9
	(446.4)	(644.0)	(617.2)	(654.1)	(371.4)
Indemnity Payment	2006.8	2028.8	997.7	2665.1	861.3
	(1496.7)	(1693.5)	(785.5)	(1997.7)	(2064.3)
Lump Sum Settlement	482.6	563.2	3.390	565.2	374.8
	(301.6)	(563.4)	(8.524)	(287.8)	(1719.2)
Employer Legal Expenses	320.9	372.9	194.8	369.5	107.4
	(135.5)	(220.7)	(246.9)	(222.4)	(137.7)
Total Spending	5811.3	5875.6	3888.4	7489.3	2940.2
	(3015.0)	(3649.0)	(2589.1)	(4237.2)	(4587.1)
Number of Lost Days	15.98	16.32	20.62	18.48	4.918
	(6.912)	(7.258)	(12.30)	(9.452)	(4.469)
Number of Permanent Disability Claims	69.30	49.71	6.655	74.25	6.826
	(87.03)	(55.94)	(10.40)	(98.17)	(14.91)
Number of Litigated Claims	92.49	62.63	0.828	111.7	1.101
	(130.3)	(89.68)	(1.695)	(144.3)	(2.090)
Observations	25	25	25	25	25

Number of observations are aggregated to the company level

There are 25 companies that switched to a non-subscription program

Total medical spending includes hospital, physician, and other medical spending

Total spending includes total medical, indemnity, settlement, and employer legal expenses

full time employees comprising 80% of all employees. The composition of industries also remained stable across both groups. Conditioning on injury, workers in switchers earned $38 higher weekly wage than workers in the non-Texas-based operations before switching, while earning $58 less after switching. Workers in switchers on average have served less time relative to the workers in their non-Texas-based operations.

Claimant and claim characteristics are shown in Table 5. On average, slightly more male workers experienced injury. The average age was 38. The number of dependents

Table 3 Summary statistics on nature of injury

Variables	All	Pre-Switching		Post-Switching	
	mean/sd	Non-TX mean/sd	TX mean/sd	Non-TX mean/sd	TX mean/sd
No Physical Injury	0.0123	0.00955	0.0133	0.0148	0.0116
	(0.0153)	(0.0114)	(0.0172)	(0.0202)	(0.0207)
Burn	0.00967	0.0102	0.00784	0.00931	0.00866
	(0.00762)	(0.00864)	(0.0110)	(0.00787)	(0.0107)
Contusion/Laceration	0.272	0.266	0.275	0.271	0.299
	(0.0958)	(0.0828)	(0.108)	(0.112)	(0.134)
Crushing	0.00663	0.00520	0.00366	0.00913	0.00667
	(0.00518)	(0.00370)	(0.00539)	(0.00856)	(0.00983)
Enucleation	0.0147	0.0144	0.0117	0.0146	0.0116
	(0.0116)	(0.0107)	(0.0164)	(0.0111)	(0.0132)
Infection/Inflammation	0.0524	0.0654	0.0514	0.0373	0.0409
	(0.0352)	(0.0570)	(0.0560)	(0.0219)	(0.0352)
Puncture/Fracture	0.0753	0.0755	0.0835	0.0760	0.0870
	(0.0688)	(0.0729)	(0.0827)	(0.0657)	(0.0834)
Strain/Sprain/Tear	0.397	0.402	0.386	0.404	0.369
	(0.134)	(0.133)	(0.148)	(0.153)	(0.146)
Unconsciousness/Strangulation	0.00363	0.00257	0.00169	0.00367	0.00583
	(0.00409)	(0.00301)	(0.00273)	(0.00599)	(0.00764)
All other Specific Injuries	0.0568	0.0655	0.0684	0.0505	0.0474
	(0.0272)	(0.0365)	(0.0606)	(0.0247)	(0.0359)
Not Provided/NOC	0.0575	0.0379	0.0374	0.0762	0.0748
	(0.208)	(0.189)	(0.186)	(0.262)	(0.258)
Mental Stress	0.00700	0.00829	0.00896	0.00563	0.00270
	(0.0136)	(0.0155)	(0.0268)	(0.0127)	(0.00623)
Multiple Physical Injuries	0.0356	0.0379	0.0510	0.0280	0.0343
	(0.0315)	(0.0440)	(0.0551)	(0.0310)	(0.0347)
Observations	25	25	25	25	25

Number of observations are aggregated to the company level. There are 25 companies that switched to a non-subscription program

and the proportion of workers who are married decreased for both groups during the post-switching period. The proportion of open claims increased for both groups during the post-switching period, with that among switchers increasing less—a 1.5 percentage-point increase compared to an 8.2 percentage-point increase among their non-Texas-based operations.

To summarize, although significant differences exist in some of the characteristics discussed above between the switchers and their non-TX based operations, the characteristics are pre-determined and are likely not correlated with the action of switching. Therefore, the differences in the characteristics are not likely to bias the estimates in our DID analysis.

Table 4 Summary statistics of employment characteristics

Variables	All	Pre-Switching		Post-Switching	
	mean/sd	Non-TX mean/sd	TX mean/sd	Non-TX mean/sd	TX mean/sd
Employment Status					
- regular	0.799	0.807	0.825	0.799	0.825
	(0.182)	(0.185)	(0.182)	(0.197)	(0.172)
- part time	0.156	0.145	0.138	0.160	0.143
	(0.167)	(0.167)	(0.184)	(0.180)	(0.175)
- other	0.0448	0.0484	0.0365	0.0409	0.0322
	(0.0689)	(0.0940)	(0.0608)	(0.0746)	(0.0593)
Standard Industrial Classification					
- food/kindred products mfrs	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- printing publishing	0.0367	0.0364	0.0142	0.0394	0.0372
	(0.183)	(0.182)	(0.0708)	(0.197)	(0.186)
-analyzing instruments mfrs	0.0800	0.0800	0.0800	0.0800	0.0800
	(0.277)	(0.277)	(0.277)	(0.277)	(0.277)
- motor freight transportation	0.0434	0.0435	0.0429	0.0432	0.0453
	(0.200)	(0.200)	(0.200)	(0.200)	(0.201)
- wholesale trade-durable goods	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- wholesale trade-nondurable goods	0.0869	0.0838	0.0800	0.0916	0.0837
	(0.275)	(0.275)	(0.277)	(0.274)	(0.276)
- building materials/hardware	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- general merchandise stores	0.237	0.237	0.237	0.237	0.235
	(0.430)	(0.430)	(0.431)	(0.430)	(0.427)
- food stores	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- automotive dealers/stations	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- apparel/accessory stores	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- eating/drinking places	0.0355	0.0359	0.0400	0.0341	0.0400
	(0.177)	(0.180)	(0.200)	(0.171)	(0.200)
- misc. retail	0.0773	0.0800	0.0800	0.0736	0.0761
	(0.268)	(0.277)	(0.277)	(0.256)	(0.264)
- depository institutions	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- hotels rooming/camps	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- personal services	0.0400	0.0400	0.0400	0.0400	0.0400

Table 4 (continued)

Variables	All	Pre-Switching		Post-Switching	
	mean/sd	Non-TX mean/sd	TX mean/sd	Non-TX mean/sd	TX mean/sd
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- health services	0.0400	0.0400	0.0400	0.0400	0.0400
	(0.200)	(0.200)	(0.200)	(0.200)	(0.200)
- other	0.00358	0.00375	0.0258	0.00123	0.00288
	(0.0167)	(0.0180)	(0.129)	(0.00426)	(0.0138)
Average Pre-Injury Weekly Wage	569.7	559.8	598.0	587.9	530.6
	(194.3)	(194.3)	(294.2)	(238.0)	(206.5)
Days of Service	1618.0	1505.6	1338.1	1793.1	1532.8
	(1242.9)	(1184.3)	(1065.8)	(1417.6)	(1283.1)
Observations	25	25	25	25	25

Number of observations are aggregated to the company level. There are 25 companies that switched to a non-subscription program

Table 5 Summary statistics on claimant and claim characteristics

Variables	All	Pre-Switching		Post-Switching	
	mean/sd	Non-TX mean/sd	TX mean/sd	Non-TX mean/sd	TX mean/sd
Male	0.526	0.533	0.500	0.524	0.505
	(0.294)	(0.292)	(0.307)	(0.293)	(0.312)
Claimant Age	37.90	37.50	37.85	38.64	38.03
	(4.172)	(3.964)	(4.079)	(4.853)	(4.435)
Number of Dependents	0.325	0.461	0.434	0.176	0.130
	(0.214)	(0.304)	(0.359)	(0.174)	(0.208)
Marital Status					
-not married	0.430	0.412	0.372	0.422	0.389
	(0.169)	(0.153)	(0.190)	(0.220)	(0.242)
-married	0.322	0.350	0.341	0.273	0.268
	(0.112)	(0.113)	(0.162)	(0.149)	(0.178)
-unknown	0.248	0.238	0.287	0.306	0.342
	(0.220)	(0.222)	(0.309)	(0.308)	(0.367)
Open Claims	0.0426	0.0140	0.0194	0.0960	0.0346
	(0.0291)	(0.0147)	(0.0794)	(0.0759)	(0.0291)
Observations	25	25	25	25	25

Number of observations are aggregated to the company level. There are 25 companies that switched to a non-subscription program

5 Econometric methods

We adopt a generalized difference-in-differences framework to estimate the impact of companies switching to non-subscription programs. The regression form we use is:

$$\mathrm{Ln}(y_{cst}+1)=\alpha_{cst}+\rho Switch_{TXt}+\beta Year_t+\eta TX_c+\gamma Company_c+\theta X_{cst}+\varepsilon_{cst}(1)$$

where c denotes the company; s denotes the state, which is Texas versus other states; and t denotes the year. ρ is the coefficient of interest because it is the outcome effect of an indicator that equals to one for a company in Texas that switches from a traditional WC program to a non-subscriber during a year between 2004 to 2016 and equals to zero for a non-Texas-based operation or a Texas operation prior to switching. β represents the coefficients on the year fixed effects, which absorb the trends that are common to all years; η are the coefficients on the Texas fixed effect, which absorb the time invariant factors that lead to differences in outcomes across Texas and each company's non-Texas based workers; γ represent company fixed effects for time invariant factors affecting outcomes that differ across companies. X represents covariates at the (mean) claim level, injury level, the employment level and the claimant level, which includes claim status, nature of injury, employment status, average pre-injury wage, days of service, SIC, gender, age, number of dependents, and marital status. We aggregate the observations to the company-state-year level. If switching to non-subscription is not correlated with average claim characteristics and other observable factors then adding covariates will not affect the DD estimate substantially. The analysis in the next section shows that this is indeed the case. Because observations within a company may be correlated, we cluster the standard errors at the company level.[9]

The identifying assumption for ρ to be an unbiased estimate is that the switchers would exhibit the same trend as the companies that do not switch had they not switched, conditional on the fixed effects and other covariates included in the model. Theoretically the parallel trends assumption is untestable since we do not observe the counterfactual state (what would have happened in Texas had the companies not switched to a non-subscription plan). However, empirically we can test for parallel trends for switchers in Texas relative to their non-Texas-based operations prior to switching. If both groups have similar pre-trends, it is more reasonable that they would continue the trend had they not switched; thus we can plausibly attribute any differences in post-switching outcomes to the impact of switching. Before reporting on the formal parallel trends test, in Online Appendix Fig. 1 we display event history graphs on the trends between the switchers and their non-Texas-based operations in the outcomes of interest mentioned above. Year 0 indicates the year when a company switched from a traditional WC program to a non-subscriber. We restrict the years to be 6 years prior to the switching and 6 years after the switching because few companies switched in the beginning or in the end of the study period. Including those companies

[9] We use OLS and a semi-log specification for our primary analysis. Because a number of our outcomes are zero we add 1 to all outcomes to avoid taking the natural log of zero. We estimated a parallel set of analyses using generalized linear models with a log link function and gamma distributional assumption and found qualitatively similar results to those reported below [results available upon request].

may produce noisy estimates. In the regressions, we include all 25 switchers and all the years controlling for other covariates. The figures suggest that the trends in most outcomes prior to the switch appear parallel, though several are questionable. In formal testing [results available upon request], only Other Medical Spending rejected the null hypothesis of parallel pre-period trends.

We adopt two strategies to deal with the pre-existing differences between the treatment and control groups. The first is to include a company-specific linear time trend in the specification to allow for a linear change in the outcomes across company and across years. The second is to perform a DDD analysis, using never switchers as another control group to difference out the contemporaneous trend that is common to both Texas and the rest of the country.

The DID results are estimated conditioning on subsequent blocks of covariates. Because the model includes more than 40 controls but the sample contains less than 600 observations at the company-state-year level, we next adopt a Post-Double-Selection (PDS) Least Absolute Shrinkage and Selection Operator (LASSO) method within the same DID framework to investigate the model selection problem. The PDS-LASSO uses theory-driven method to select controls that have predictive power for the dependent variable and the main variable of interest (the switch variable in eq. 1) (Belloni et al. 2014). By selecting only necessary controls, PDS-LASSO generates good performance in estimation and imposes as few restrictions as possible on the model.

There are three steps to the PDS-LASSO estimation. The first step is to use the LASSO method to estimate the dependent variable y_{cst} using the same specification as eq. (1) while excluding the main variable of interest $Switch_{TXt}$:

$$y_{cst} = a_{cst} + \beta Year_t + \eta TX_c + \gamma Company_c + \theta_{cst} + \varepsilon_{cst} \tag{2}$$

The second step is to use the LASSO method to regress $Switch_{TXt}$ on the same set of covariates in Eq. (2):

$$Switch_{TXt} \equiv a_{cst} + \beta Year_t + \eta TX_c + \gamma Company_c + \theta X_{cst} + \varepsilon_{cst} \tag{3}$$

The third step is to regress y_{cst} on $Switch_{TXt}$ and the common controls selected from steps 1 and 2:

$$y_{cst} = \rho Switch_{TXt} + w'_{cst}\beta + \varepsilon_{cst} \tag{4}$$

where w'_{cst} is the union of the selected controls from steps 1 and 2. We compare the PDS-LASSO output with the output from the standard DID model in the results section below.

6 Empirical results

In the second column of Table 6 we present the DID results on the outcomes described above. The third column provides the PDS-LASSO estimates. We note at the outset that the LASSO approach provides results generally consistent with the findings from the

Table 6 Summary difference-in-differences estimates on the effect of non-subscription

	OLS DID Results	PDS-LASSO Results	Mean of Dep.Var.
1: Log estimate on number of claims	−0.025 (0.137)	−0.069 (0.127)	1188.72
2: Log estimates on number of denied claims (claims+1)	0.891** (0.312)	0.970** (0.326)	124.62
3: Log estimate on the number of claims involving obvious injuries (claims+1)	−0.133 (0.146)	−0.105 (0.151)	420.37
4: Log estimate on total medical spending (spending+$1)	−0.536* (0.200)	−0.715*** (0.186)	3,323,119
5: Log estimate on hospital spending (spending+$1)	−0.770* (0.348)	−0.873** (0.272)	577,309
6: Log estimate on physician spending (spending+$1)	−0.346 (0.249)	−0.486* (0.232)	1,006,106
7: Log estimate on other medical spending (spending+$1)	−0.663* (0.285)	−0.859** (0.249)	1,334,752
8: Log estimate on indemnity payments (indemnity+$1)	−1.219** (0.303)	−1.408** (0.348)	1,575,790
9: Log estimate on number of lost days (lost days+1)	−1.650*** (0.231)	−1.876** (0.241)	17,524
10: Log estimate on the number of permanent disability claims (claims+1)	−0.650** (0.200)	−0.667** (0.181)	33.14
11: Log estimate on the number of litigated claims (claims+1)	−0.307 (0.165)	−0.306* (0.122)	48.46
12: Log estimate on total payments (payment+$1)	−0.618** (0.209)	−0.784** (0.207)	5,649,966

Number of observations are aggregated to the Texas/non-Texas-company-year level, $n = 566$. Each cell reflects the key DID coefficient of interest in a separate regression

The DID specification includes all covariates: year FE, Texas FE, company FE, claim status, nature of injury, employment and individual characteristics

Claim status includes: open claims and closed claims. Nature of injury includes: no physical injury, burn, contusion/laceration, crushing, enucleation, infection/inflammation, puncture/rupture/fracture/dislocation, strain/sprain/tear, unconsciousness/strangulation, others, multiple injuries. Employment characteristics include: employment status, Standard Industrial Classification, average pre-injury weekly wage, length of service. Individual characteristics include: gender, age, number of dependents, marital status

Standard errors in parentheses, clustered at the company level

PDS-LASSO: Post-double-selection least absolute shrinkage and selection operator

* $p < 0.05$, ** $p < 0.01$

traditional approach. In Online Appendix Tables 1–16 we display results for each outcome as additional groups of covariates are added for purposes of examining the robustness of our results. In general, we do not observe a great deal of sensitivity of the point estimates to the inclusion of additional controls, suggesting that there was not a meaningful change in the characteristics of injury claims coincident with the switch to non-subscription.

We start by examining total claims for non-denied benefits that incur at least some medical expense in Row 1 of Table 6. We observe no statistically significant change in the

number of claims reported after non-subscription. However, consistent with the potential for a reporting effect under non-subscription, we see in Row 2 a roughly 165% increase in the number of denied claims after non-subscription (including zero-dollar value claims). When we look just at the number of denied claims excluding zero-dollar claims (presented in Online Appendix Table 13) we see a roughly 300% increase in the number of denied claims after non-subscription. Thus, the overall picture suggests that, contrary to the concern that non-subscription might dampen the willingness to report workplace injuries, there is a tendency to over-report potential injury incidents after switching to non-subscription. However, many of the additional claims either incur zero medical spending or are denied. In Row 3 we condition on a set of plausibly unambiguous injury types from amputation to enucleation (loss of an eye). Although the coefficients are negative, we do not observe a statistically significant difference from zero.

Row 4 presents the effect of non-subscription on total medical spending incurred. The log results suggest a 41–46% drop in total medical payments conditional upon reporting an injury, controlling for other characteristics. We then disaggregate the medical spending into three components. Rows 5–7 show that the reduction in total medical spending comes from a 54% decline in hospital spending, 29% reduction in physician spending, and 49% decrease in other medical spending. The spending component reductions are consistent with the notion that non-subscription programs are better able to avoid hospitalizations of injured workers.

In terms of indemnity payment, the estimate from Row 8 indicates a 70% decline in indemnity payment. Consistent with the drop in indemnity payments, Row 9 displays regression results for the log of the number of days lost. The results show that the switch to non-subscription is associated with a roughly 80% reduction in work-loss. The data are not rich enough to determine if this more speedy return to work is the result of non-subscribing firms forcing injured workers to return to work prematurely, preventing workers from malingering after injury, or providing their injured workers more expeditious or better medical services allowing them to recover more quickly.

In Row 10 we present estimates on the number of permanent disability claims. Switching to non-subscription reduced the number of permanent disability claims by 40%. The permanent disability claims reduction may reflect an improvement in safety at non-subscribing firms. Alternatively, the reduction may reflect that most private disability plans do not explicitly cover injuries resulting in permanent partial or permanent total impairments. The plans also generally exclude injuries where age or other non-work conditions contributed to the impairment, which may reduce the number of permanent disability claims. Finally, workers' compensation legislation prevents firms from firing workers who file claims for benefits. No such protection is afforded workers in non-subscribing firms, meaning the reduction in permanent disability claims may simply reflect a lower willingness of workers in non-subscribing firms to file a claim fearing the possibility of dismissal (Morantz 2016).

Row 11 presents estimates on the number of litigated claims. Under non-subscription we observe a roughly 35% decrease in the number of litigated claims. The litigated claims result may be somewhat surprising: WC insurance provides injured workers with known but limited benefits in return for not having to prove employer negligence in a court of law. As discussed previously, although firms must provide medical and disability benefits to injured workers regardless of fault, the injuries must arise out of and in the course of employment and such determinations can result in

litigation. Litigation arises in non-subscribing firms if there is a dispute over coverage or if there is a dispute over negligence. ERISA dictates that workers must appeal a denial of benefits internally before they can go externally to a court of law, reducing the number of litigated claims. Additionally, the difficulty of proving employer negligence may prevent many workers from filing suits for damages, reducing the number of litigated cases. And, employers may wish to avoid negligence trials over damages, with potentially costly awards if found liable, and choose to settle before going to court. Many non-subscribing firms attempt to reduce litigation by requiring mandatory arbitration over questions of negligence. The results indicate the combination of ERISA requirements and worker and firm incentives to avoid lawsuits have successfully limited the number of litigated claims for non-subscribing firms.

Finally, in Row 12 we present results for total spending, including all sources: medical, indemnity, settlement, and litigation. Consistent with prior results, total spending is roughly 46% lower in Texas after non-subscription.

Given the large number of outcomes studied, when we Bonferroni-adjust our standard errors to account for multiple outcomes, all our results are still statistically significant with the exception of total medical spending, which was borderline significant in unadjusted results.

How the effect of non-subscription evolves over time is of great interest. The self-insured employers might be extra cautious initially after switching to non-subscription program-leading larger effects in the first year after switching, and the effects may die out in the later years. Table 7 displays the estimates on the effects of switching over time. As in Table 6 the model is the preferred specification including all the covariates including linear company-specific time trends. For some outcomes the effects increase over time while others diminish. Claims reporting tends to fall over time as do denials. The negative medical spending effects tend to get larger over time as do the indemnity effects. Litigated claims also fall over time. If workers with high injury risk differentially sort out of non-subscription firms we would expect to see magnified effects over time. However, such sorting is likely to be second order in nature.

Finally, we perform DDD analysis using firms that never switch to non-subscription. The results are shown in Table 8. The estimates are robust to the use of never-switchers as an additional control group. Compared to the DID results, the effect of switching to non-subscription in the triple difference approach is strikingly consistent.

7 Conclusion

We find that switching to a non-subscription program from a traditional workers' compensation arrangement in Texas led to important changes in outcomes. While denied claims increased substantially, there was no statistically significant change in non-denied claims that incurred positive medical spending. We also examined whether unambiguous ("hard-to-fake") injury types changed after non-subscription and found no evidence of a change. The results suggest that people may have increased reporting of potential workplace injuries to insure against failing to report within the 1-day reporting period. Theory suggests that workers in the presence of reduced disability benefits might exhibit more care (ex ante moral hazard) in the workplace, but it is difficult to discern from our administrative data whether workplace safety was altered.

Table 7 Summary OLS estimates on the effect of non-subscription over time

	Year 1 Post	Year 2 Post	Year 3+ Post	Mean of Dep.Var.
1: Log estimate on number of claims	0.155 (0.155)	0.019 (0.139)	−0.318* (0.117)	1188.72
2: Log estimates on number of denied claims (claims+1)	0.950** (0.289)	0.862** (0.302)	0.635* (0.290)	124.62
3: Log estimate on the number of claims involving obvious injuries (claims+1)	0.016 (0.137)	−0.100 (0.132)	−0.402* (0.150)	420.37
4: Log estimate on total medical spending (spending+$1)	−0.306 (0.188)	−0.614*** (0.143)	−0.843*** (0.145)	3,323,119
5: Log estimate on hospital spending (spending+$1)	−0.407 (0.412)	−1.324** (0.401)	−1.347*** (0.351)	577,309
6: Log estimate on physician spending (spending+$1)	−0.056 (0.233)	−0.282 (0.165)	−0.639** (0.199)	1,006,106
7: Log estimate on other medical spending (spending+$1)	−0.261 (0.276)	−0.627* (0.253)	−1.077*** (0.262)	1,334,752
8: Log estimate on indemnity payments (indemnity+$1)	−1.036* (0.377)	−1.338** (0.363)	−1.448*** (0.285)	1,575,790
9: Log estimate on number of lost days (lost days+1)	−1.336*** (0.29)	−1.498*** (0.225)	−1.786*** (0.231)	17,524
10: Log estimate on the number of permanent disability claims (claims+1)	−0.793*** (0.197)	−0.532* (0.221)	−0.463 (0.252)	33.14
11: Log estimate on the number of litigated claims (claims+1)	−0.100 (0.128)	−0.125 (0.157)	−0.564*** (0.120)	48.46
12: Log estimate on total payments (payment+$1)	−0.387 (0.202)	−0.681*** (0.150)	−0.895*** (0.156)	5,649,966

Number of observations are aggregated to the Texas/non-Texas-company-year level, n = 566. Each row represents a separate regression

The specification includes all covariates: year FE, Texas FE, company FE, claim status, nature of injury, employment and individual characteristics

Claim status includes: open claims and closed claims. Nature of injury includes: no physical injury, burn, contusion/laceration, crushing, enucleation, infection/inflammation, puncture/rupture/fracture/dislocation, strain/sprain/tear, unconsciousness/strangulation, others, multiple injuries. Employment characteristics include: employment status, Standard Industrial Classification, average pre-injury weekly wage, length of service. Individual characteristics include: gender, age, number of dependents, marital status

Standard errors in parentheses, clustered at the company level

* $p < 0.05$, ** $p < 0.01$

Additionally, if worker composition changes in response to non-subscription—say to a less risk averse, healthier workforce—there could be a bias toward finding fewer severe injuries. We find some evidence for significant claim decreases 3+ years after non-subscription.

Our results indicate that total medical payments dropped by roughly 40%, which consisted of reductions in hospital spending, physician spending, and other medical spending. Similarly, indemnity payment and work loss also experienced significant reductions as a result of switching. Specifically, indemnity payments dropped by

Table 8 Summary DDD estimates on the effect of non-subscription

	DDD Results	Obs	Mean of Dep. Var.	DD Results
1: Log estimate on number of claims	0.026 (0.165)	10,137	368.9	−0.025 (0.137)
2: Log estimates on number of denied claims (claims+1)	1.428*** (0.317)	10,240	33.98	0.891** (0.312)
3: Log estimate on the number of claims involving obvious injuries (claims+1)	−0.192 (0.242)	10,137	105.34	−0.133 (0.146)
4: Log estimate on total medical spending (spending+$1)	−0.556* (0.202)	10,137	1,255,004	−0.536* (0.200)
5: Log estimate on hospital spending (spending+$1)	−0.779** (0.324)	10,137	204,211.5	−0.770* (0.348)
6: Log estimate on physician spending (spending+$1)	−0.239 (0.259)	10,137	417,421.9	−0.346 (0.249)
7: Log estimate on other medical spending (spending+$1)	−0.786** (0.282)	10,137	465,095.6	−0.663* (0.285)
8: Log estimate on indemnity payments (indemnity+$1)	−1.254*** (0.327)	10,137	867,162.2	−1.219** (0.303)
9: Log estimate on number of lost days (lost days+1)	−1.681*** (0.254)	10,137	6774.4	−1.650*** (0.231)
10: Log estimate on the number of permanent disability claims (claims+1)	−7.297 (6.333)	10,240	17.23	−0.650** (0.200)
11: Log estimate on the number of litigated claims (claims+1)	−0.136 (0.137)	10,137	20.50	−0.307 (0.165)
12: Log estimate on total payments (payment+$1)	−0.644** (0.210)	10,240	2,394,088	−0.618** (0.209)

Number of observations are aggregated to the Texas/non-Texas-company-year level. Each cell reflects the key DID coefficient of interest in a separate regression. DD results included from Table 6 as a reference

The specification includes all covariates: year FE, Texas FE, company FE, claim status, nature of injury, employment and individual characteristics. Claim status includes: open claims and closed claims. Nature of injury includes: no physical injury, burn, contusion/laceration, crushing, enucleation, infection/inflammation, puncture/rupture/fracture/dislocation, strain/sprain/tear, unconsciousness/strangulation, others, multiple injuries. Employment characteristics include: employment status, Standard Industrial Classification, average pre-injury weekly wage, length of service. Individual characteristics include: gender, age, number of dependents, marital status

Standard errors in parentheses, clustered at the company level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

70% and number of lost days dropped by 80%. Accumulating all sources of spending, we find that total expense associated with workplace injury fell by approximately 46% after switching to the non-subscription program. We find non-subscription is associated with a reduction in permanent disability claims and litigated claims. Although comparatively rare, non-subscription was associated with greater lump sum settlement payments to injured workers. This is consistent with severing the no-fault nature of the traditional WC system. We also show that in general the effects of non-subscription on the outcomes tend to increase over time. Finally, our findings are consistent when we estimate triple-difference models using companies that never switch to non-subscription and by the use of a novel machine learning approach to estimation.

It should be noted that we cannot rule out substitution from the company disability system to treatment in the employer sponsored health insurance program, though such substitution might be unlikely given the need for cost-sharing under health insurance. Nevertheless, a claim denied under the disability program could generate spending under the health insurance program. Hence from a total cost to employer perspective we may only be observing partial effects.

Given the generally positive nature of the findings (at least from the employer perspective), it is worth questioning why more large employers do not switch to non-subscription plans in Texas. First, instituting a non-subscription plan in Texas for a national company entails the fixed costs of a second workplace injury management system operating in parallel to the traditional WC system in operation elsewhere in the United States. Second, our data suggest that Texas appeared to have very low rates (and dollar amounts) of lump sum settlement payments in the pre-period under the traditional WC system. After switching, lump-sum settlements increased in both their frequency and their variance, the exposure to which may at least partially offset the savings in medical and indemnity spending and may explain why some companies in Texas choose to remain in the traditional WC system. It could be that given earlier WC reforms in Texas, employers do not perceive of Texas as a problem with respect to WC. Third, in a large firm with a national footprint, having a different benefit structure in one state could raise equity concerns relating to benefits equivalence, which could have adverse implications for recruitment and retention in Texas. Finally, any company that serves as a federal or state contractor is required to carry traditional WC insurance. Because of the reasons just mentioned above, it may not be a straightforward decision to choose non-subscription in a single state. In sum, the traditional workers' compensation system could likely benefit from the lessons from Texas' non-subscription experience, but more study of the effects on worker well-being is warranted.

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