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Bernard Black

David A. Hyman

Charles Silver

William M. Sage

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Bernard Black, *University of Texas,* David A. Hyman, *University of Illinois,* Charles Silver, *University of Texas*, and William M. Sage, *University of Texas*

We study defense costs for commercially insured personal injury tort claims in Texas over 1988–2004, and insurer reserves for those costs. We rely on detailed case-level data on defense legal fees and expenses, and Texas state bar data on lawyers' hourly rates. We study medical malpractice ("med mal") cases in detail, and other types of cases in less detail. Controlling for payouts, real defense costs in med mal cases rise by

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Send correspondence to: Bernard Black, Professor of Law, University of Texas Law School, 727 East Dean Keeton St., Austin, TX 78705, USA; E-mail: bblack@law.utexas.edu.

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4.6 percent per year, roughly doubling over this period. The rate of increase is similar for legal fees and for other expenses. Real hourly rates for personal injury defense counsel are flat. Defense costs in med mal cases correlate strongly with payouts, both in ordinary least squares (OLS) and in an instrumental variable analysis. They also correlate with the stage at which a case is resolved, and case duration. Mean duration declined over time. Med mal insurers predominantly use outside counsel. Case-level variation in initial expense reserves predicts a small fraction of actual defense costs. In other areas of tort litigation (auto, general commercial, multi-peril, and other professional liability), defense costs rose by 2.2 percent per year. Defense costs in these cases are predicted by the same factors as in med mal cases, plus the presence of multiple defendants.

Insurer reserving practices raise some puzzles. Med mal insurers did not react to the sustained rise in defense costs by adjusting their expense reserves, either in real dollars or relative to reserves for payouts. Thus, expense reserves declined substantially relative to defense costs. In other litigation areas, expense reserves rose along with defense costs. (*JEL* K13, K32, K41)

1. Introduction

Tort litigation is expensive. Plaintiffs recover only a fraction of what defendants and their insurers spend; legal fees and expenses and indirect insurer costs account for the rest. But little is known about the factors that affect tort litigation costs, and the components of those costs. How much goes to defense lawyers, versus other direct expenses? Are defense costs changing over time? What case-level factors predict these costs? To what extent do insurers rely on inside (“staff”) counsel versus outside counsel? Do the answers to these questions depend on the type of case? Even less is known about how insurers set case-level reserves, or how well case-level variation in reserves predicts variation in eventual cost. We begin to answer these questions in this article. We focus on medical malpractice, but also present evidence on four other types of personal injury cases.

We employ a unique Texas Department of Insurance (TDI) database of all closed, commercially insured Texas claims for bodily injury over 1988–2004 with payout over $25,000.[1] This database covers five lines of

1. Unless otherwise indicated, all dollar amounts in this paper are in 1988 dollars; computed using the Consumer Price Index for All Urban Consumers (annual average) as a price index. Source: www.bls.gov/cpi/. To convert to 2007 dollars, multiply by 1.75.

commercial insurance: auto, general commercial, multi-peril, medical malpractice professional liability, and other professional liability.[2] We supplement the TDI database with data on defense lawyers' hourly rates for 1989–2005, based on periodic Texas bar surveys.

Defense costs and payouts are endogenously determined. We cannot directly observe a variable one might call "exposure"—expected payout assuming an average level of defense spending. We address this issue using a two-stage least squares (2SLS) analysis, using basic case characteristics (ln(plaintiff age + 1), baby dummy, and employed dummy) as instruments for payout. These characteristics predict payout and it is plausible that they predict defense costs only through their effect on payout, as required for a valid instrument. They collectively pass a Hansen test (which assumes at least one valid instrument), and each individually passes a "difference-in-Hansen" test (which assumes the validity of the other instruments). Assuming valid instruments, instrumented payout should not be affected by case-level choices on defense cost, and thus should be a reasonable proxy for exposure.

Our principal findings are as follows. In this article, unless we specifically state otherwise, all references to defense costs are to per case amounts; and all dollar amounts are in 1988 dollars.

For medical malpractice ("med mal") cases:

- Inflation-adjusted defense costs rose at 4.5–5.5 percent per year, depending on specification, controlling for exposure. By the end of our sample period, total defense costs equaled 18 percent of total payouts and annual defense costs were running at about $150 million (in 2007 dollars).
- The rate of increase is similar for legal fees and for other costs. Legal fees were 77 percent of total defense costs; other out-of-pocket costs (expert witness fees, depositions, copies of medical records, court costs, and the like) account for the remaining 23 percent.

2. This paper is one of a series based on the Texas database. Other papers are Black et al. (2005) (trends in overall payouts, referred to below as *Stability, Not Crisis*); Hyman et al. (2007) (comparing jury verdicts with actual payouts, referred to below as *Jury Verdicts*); Zeiler et al. (2008) (physician policy limits and out-of-pocket payments, referred to below as *Policy Limits*); and Hyman et al. (2008) (effect of caps on non-economic damages on payouts).

- Insurers rely primarily on outside counsel. Outside counsel account for 99 percent of total counsel expense in 2003–2004.
- Insurers' defense costs rise with exposure, the stage at which the case is resolved, and duration (how long a claim is open).
- We find no evidence to support a number of possible explanations for rising defense costs, including rising payouts, rising exposure, rising hourly rates for defense counsel, longer duration, and more cases going to trial. The rise in defense costs remain unexplained.

Comparing med mal to other types of commercially insured personal injury cases ("other areas"):

- Cases in other areas cost less to defend. Defense costs in such cases also rose, but more slowly (2–3 percent per year, depending on specification).
- Defense costs in other areas rise with the same factors that predict defense costs in med mal cases, plus the presence of multiple defendants (which is insignificant in med mal cases). Outside counsel account for 94–97 percent of counsel expense, with greater use of inside counsel in smaller cases.

Insurer reserving practices:

- In med mal cases, case-level variation in initial expense reserves is a poor predictor of variation in eventual cost. We obtain substantially better prediction of defense cost using basic case information (year, plaintiff age, employment status, type of harm).
- Despite the doubling in per case defense costs over our sample period, med mal insurers did not increase their initial expense reserves over this period.
- In other areas, in contrast, insurers increased their initial expense reserves to reflect the rise in defense costs.

The principal surprises in this research are: (i) the secular rise in defense costs, especially in med mal cases; (ii) the failure of med mal insurers (but not other insurers) to adjust their initial expense reserves to reflect rising costs; and (iii) med mal insurers' poor prediction of case-level variation in defense costs when they establish initial expense reserves. Many of our other findings are consistent with sensible insurer behavior. For example, insurers invest more to defend cases with larger exposure, and spend more the further along the case gets and the longer it lasts.

Section 2 describes previous studies of tort litigation costs. Section 3 describes our datasets. Section 4 presents our basic findings on defense costs in med mal cases. Section 5 discusses insurer expense reserves in med mal cases. Section 6 compares defense costs and expense reserves in med mal cases to costs and reserves in other areas. Section 7 discusses possible explanations for rising defense costs. Section 8 discusses some implications of our findings. Section 9 concludes.

2. Related Prior Research

2.1. Defense Costs in Medical Malpractice and Other Tort Litigation

Estimates of the overall cost of med mal litigation, including legal fees and expenses for plaintiff and defendant, plus insurers' administrative costs, typically exceed 50 percent of the total premium dollars collected by insurers.[3] However, the estimates are often partly or entirely anecdotal. Moreover, studies frequently use different definitions of the sample, the numerator, and the denominator.[4] When the original source permits, we report estimates

3. Estimates include Anderson (2004), at 1175 ("Only $0.28 of every dollar of premium is paid in indemnity—the rest is consumed in attorneys' fees and administrative expenses."); Hyman (2002, at 1645) ("for every dollar that reaches an injured patient, almost two additional dollars are spent getting it there"); Weiler (1993, at 17) ("only about 40 percent of the total amount expended in the claims process actually reaches injured patients"); Richards and Thomasson (1992, p. 313) ("only 28 cents of every premium dollar goes to injured patients"); Sugarman (1991, p. 1502) ("to deliver $1 in net compensation . . . more than $1.35 is spent on claims processing costs . . .. [A]dditional transactions costs not directly attributable to claims processing, including commissions, marketing expenses, and taxes paid and profits earned by insurers . . . probably amount to more than twenty percent of the cost of medical liability insurance."); Newhouse and Weiler (1991) ("About 55 percent of malpractice premium dollars represent administrative costs, largely attorneys' fees and expert witness' fees."); O'Connell (1976, pp. 506–8) (estimating that 42 percent of premium dollar is consumed in attorneys fees, and citing various other estimates of total costs as high as 84 percent of the premium dollar.)

4. Studies can report either direct defense costs or direct plus indirect defense costs; and can use either payouts or premiums collected as the denominator. The numerator and denominator can be based either on actual costs for closed claims, or on "incurred" amounts, which combine data on closed claims with estimated future costs for open claims. They can be based only on paid claims, or on both paid claims and claims

of direct defense costs (legal fees and other out-of-pocket costs) as the numerator, and (defense costs plus payout) as the denominator. We thus omit indirect costs, such as insurers' administrative, marketing and other expenses.

2.1.1. Snapshots of med mal litigation. We focus here on quantitative research on defense costs in *paid* claims. We review the evidence on defense costs for zero-payout claims in Section 8. Studdert *et al.* (2006) examine defense costs for a random sample of 1,452 med mal claims from five liability insurers closed during 1984–2004. They found that for paid claims, legal fees and expenses were 11 percent of the sum of payouts plus defense costs.[5] The Bureau of Justice Statistics (Cohen and Hughes, 2007) reports data for paid, closed med mal claims during 2000–2004. Median loss adjustment expenses for claims settled without trial were 14 percent of the sum of payouts plus defense costs in Missouri; 19 percent in Florida; and 24 percent in Texas. For paid claims in tried cases, (median loss adjustment expenses/(median payout) were 14 percent (Nevada); 16 percent (Missouri); 23 percent (Maine); 26 percent (Texas); and 43 percent (Florida). For Texas, the authors use the same TDI database we rely on.[6]

Vidmar et al. (2005, pp. 350, 353) find that legal fees and expenses in paid claims in Florida, closed over 1990–2003, were 14 percent of the sum of payouts and defense costs. Connecticut Insurance Department (2007) finds that for paid claims in Connecticut, closed during 2005–2006, legal fees averaged 14 percent and other defense costs another 3 percent of indemnity payments. Richards (1996, p. 1907) finds that legal fees and expenses for

closed without payout. The percentages reported here use (payout + defense cost) as the denominator, and thus differ from those reported in the original studies. The adjustments are straightforward. Let D = defense costs, P = payouts, and A = administrative costs. If the original study reports D/P, we compute D/(D + P) as (D/P)/[(D/P) + 1]. If the original study reports D/(P + D + A), we compute D/(D + P) as D/[(D + P + A)(1 – A/(D + P + A)). If a study reports amounts in nominal dollars, we convert to real dollars based on the Consumer Price Index.

5. Studdert et al. (2006, at 2028), supplemented by email correspondence with David Studdert and Michelle Mello.

6. Authors' calculations based on tables 6 and 7 of Cohen and Hughes (2007). Loss adjustment expenses is the term insurers use for legal fees and direct expenses associated with defending a case. Estimate for Texas cases settled before trial reflects a weighted average of the medians for cases resolved after suit and cases resolved before suit.

353 malpractice claims (of which 106 were paid), closed over 1983–1991, were 25 percent of the sum of payouts and defense costs. Danzon (Munch) (1977, Table M-8 and p. 85) estimates that legal fees and expenses in paid med mal cases over 1975–1976 were 10–14 percent of the sum of payouts and defense costs.

2.1.2. Snapshots of tort litigation in general. A widely cited study by Tillinghast-Towers Perrin (2003, p. 17) of tort litigation in general found that "incurred" defense costs (the sum of actual costs and estimated future costs for open claims) totaled 18 percent of the sum of incurred indemnity expenses and incurred defense costs.[7] An early Rand Institute for Civil Justice synthesis of various studies (Hensler *et al.*, 1987, pp. 25–9) estimated that defense-side fees and expenses in non-auto tort cases in 1985 were 30 percent of the sum of defense costs and payouts. A second Rand report (Kakalik and Pace, 1986, p. 113) found that defense costs and expenses were 27 percent (15 percent) of the sum of defense costs and payouts in state (federal) court.

2.1.3. Time trends. Evidence on time trends is limited and mixed. Congressional Budget Office (2004) reports that defense costs in med mal cases have been increasing over the past two decades. A State of Washington study (2005) found a 3.8 percent overall annual real increase over 1995–2004, and a 5.8 percent annual rise in cases with positive payout. In Florida, the defense cost data reported by Vidmar *et al.* (2005, Tables 14 and 15) implies that mean defense cost for paid claims declined during 1990–2003 by an average of 2.8 percent per year, yet mean cost in claims with no payment rose by an estimated 3.1 percent per year over 1990–1997. Kessler (2006, Table 1) reports that loss adjustment expense in med mal cases declined from 24.7 percent of the sum of incurred losses and loss adjustment expenses in 1992 to 23.4 percent in 2002.

7. The 2006 update to this periodic report does not provide a breakout of defense costs. *See also* Council of Economic Advisers (2002, p. 9) (relying on a pre-2003 Tillinghast report, estimating that incurred defense costs are 21 percent of the sum of incurred indemnity expenses plus incurred defense costs).

2.1.4. Claim characteristics. Two studies by Insurance Services Offices, Inc. (1992, 1998, p. 17) indicate that defense costs correlate with claim characteristics, including the type of coverage, the number of defendants, case complexity, whether liability is a close question, and claim value. The ratio of defense costs to payouts is higher for smaller claims.

2.1.5. Inside versus outside counsel. Little is known about the factors that lead insurers to choose inside versus outside counsel. Insurers are reported to have experimented with various mechanisms for controlling legal costs, including flat rates and use of in-house counsel.[8]

2.1.6. Hourly rates. We are not aware of prior efforts to study hourly rates for personal injury defense counsel, or how these rates vary over time.

2.1.7. Hersch and Viscusi. A contemporaneous study by Hersch and Viscusi (2007) also uses the TDI database, but does not focus on med mal cases. They report that defense costs in individually reported claims ($10,000 nominal or more) average $22,000 ($38,000 in med mal cases) (1988 dollars). Defense costs average 22 percent (25 percent) of payouts in all cases (med mal cases), and increased at 2.9 percent (3.7 percent) per year for all cases (med mal cases) over 1988–2004.

Hersch and Viscusi do not study reserving practices, and use initial indemnity reserve in their predictive regressions. They claim that these reserves are exogenous; we show below that they are endogenous. They report that insurers send more complex claims to outside counsel; we find mixed evidence on this question.

2.2. Insurer Reserving Practices

We assess below how well insurers do in establishing initial expense reserves. We are not aware of prior work on when, during the claim process, these reserves are set, or on how well case-level reserves predict case-level spending. For a review of the literature on aggregate reserving accuracy, see Grace and Leverty (2007).

8. Silver (1997–1998).

3. Data Sources and Methodology

3.1. Principal Source for Defense Costs: Texas Closed Claims Database

Our principal data source for defense costs is the Texas Closed Claims Database (TCCD). This is a public database of closed personal injury claims from 1988 on, covered by five lines of commercial insurance: general liability, auto liability, multi-peril, medical professional liability, and other professional liability insurance. We describe this database in Black *et al.*, *Stability, Not Crisis* (2005), so we only summarize here. The TCCD contains insurer reports for all claims involving payouts by all defendants of more than $10,000 in nominal dollars; data at the time of this study were available through 2004. TDI check reports for internal consistency and reconciles individual reports with insurers' aggregate annual reports.[9]

A "claim" is an incident causing bodily injury, for which a policyholder requests coverage. Insurers file reports with TDI in the year a claim "closes"—when the insurer "has made all indemnity and expense payments on the claim" (TDI, 2004, p. 18). When total known payments to a claimant by all defendants equal $25,000 (nominal) or more, the primary carrier for each defendant must complete a "Long Form" report. If total payments are $10,001–24,999 (nominal), each primary carrier must complete a "Short Form," which omits the cause of injury. Claims with total payments of $10,000 (nominal) or less are not individually reported. The primary carrier files an aggregate annual report that lists the number of closed claims and total payout to claimants, but no information on defense costs. [10]

We convert all payouts to 1988 dollars using the *Consumer Price Index for All Urban Consumers* (CPI). To convert to 2007 dollars, multiply by

9. TDI has acknowledged potential problems with reporting completeness and consistency in 1988 and 1989. These problems do not appear to bias the sample of claims that were reported in those years. See Black *et al.*, *Stability, Not Crisis* (2005).

10. Summary TDI "Closed Claim Annual Reports", and the data on which we rely are available at http://www.tdi.state.tx.us/reports/report4.html. The TDI Closed Claim Reporting Guide, containing reporting instructions, is available at http://www.tdi.state.tx.us/webinfo/datacall.html. In some cases, the online data was incomplete and we used information provided to us directly by TDI.

1.75. We study "large paid claims"—claims with payout of at least $25,000 in 1988 dollars (roughly $44,000 in 2007 dollars).[11]

3.1.1. Med mal cases. The TCCD offers several plausible ways of identifying med mal claims—based on type of insurance, type of defendant, and cause of harm. Consistent with our prior work, we rely on a med mal dataset (called BRD_{minus} in prior work) which meet two of the following three criteria:

- The claim was paid under medical professional liability insurance;
- The claim was against a physician, hospital, or nursing home;
- The claim involved injuries caused by complications or misadventures of medical or surgical care.[12]

Our med mal dataset includes 16,116 reports involving total payouts over 1988–2004 of $4.6 billion and total defense costs of $617 million.

3.1.2. Handling duplicate reports. Many med mal cases involve multiple defendants. Beginning in 1991, TDI sought to identify multiple reports relating to the same incident in the same year ("duplicate reports"). We review all med mal claim reports to identify duplicate reports not identified by TDI, including duplicate reports for 1988–1990 and duplicate reports filed in different years, and to identify which particular reports involve the same case (which TDI does not do). We designate the last-closed claim

11. The TDI reporting thresholds are not inflation-adjusted. Thus, some claims that are reported on the Long Form in later years would have been reported on the Short Form in earlier years. To address this "bracket creep," we exclude from the sample cases with payouts by all defendants between $25,000 nominal and $25,000 real (there are 1,100 nonduplicate med mal cases in the wedge between these two amounts). We exclude from the dataset one med mal case with resolution stage coded as "other"; two outlier auto liability cases with defense costs >$5 million; and, following Hersch and Viscusi (2007), 1,375 general commercial liability cases closed in 1997 with "other products manufacturer" as the defendant type, most of which apparently involve a mass settlement by a single defendant.

12. We also include cases that meet one of these criteria and otherwise seem likely to involve medical malpractice. For example, we include cases against nursing homes that were paid under other professional liability insurance. We treat cases paid under auto liability insurance as auto cases even if they meet the other two med mal criteria. In robustness checks, we obtain similar results if we define med mal cases simply as cases covered by med mal insurance.

report as the primary report and the defendant in this report as the primary defendant. Our dataset includes 14,241 nonduplicate cases.

For med mal cases, we generally sum payouts and defense costs across all reports relating to the same claim. When the analysis involves reserves, which are insurer-specific, we examine each insurer's report separately and define payout as the sum of amounts paid by the particular defendant, its primary insurer, and its excess insurer, if any. These are the payouts against which the reporting insurer is likely defending. Excess insurers usually rely on primary insurers to defend cases, and do not engage separate counsel. We indicate below where we sum across duplicate reports and where we examine reports separately.[13]

3.1.3. Other types of cases. For the other four areas of commercial liability claims (general commercial, auto, multi-peril, and other professional liability), we use the type of insurance to determine the type of claim, except (i) we remove any med mal cases; and (ii) we treat cases that are covered by medical professional liability insurance but are not med mal cases, as "other professional liability" cases (over 90 percent of these cases are against dentists). For areas other than med mal, we rely on TDI to identify duplicate reports, and therefore cannot sum across duplicate reports to measure total defense costs for a particular claim. We judged that the benefit from hand-matching original and duplicate reports was not worth the large effort required. Only 2 percent of reports in other types of cases are duplicates, compared to 12 percent in med mal cases.

3.1.4. Insurer reserves. For each claim, insurers must report their initial reserves and their final reserves (just before closing the claim) for both defense costs and indemnity.

13. In robustness checks, we obtain similar results if we define payout to exclude out-of-pocket payments by defendants, payments by excess insurers, or both. In identifying duplicate reports, we sometimes exercise judgment when claim reports are similar but not identical. Insurers also make some reporting errors that TDI does not catch. In a few cases when both the error and the correction were apparent, we corrected the underlying data. Details on the procedure we used to identify duplicates, the data adjustments we made, and our criteria for inclusion in the med mal dataset are available from the authors on request.

3.2. TCCD Dataset Details and Limitations

The TCCD includes a number of important limitations, which affect this study:

General data limitations. We have no data on open claims, or on closed claims with payouts of less than $25,000. The large paid claims that we study are responsible for a large fraction of aggregate payouts (ranging from 74 percent in auto cases to almost 99 percent in med mal cases), but a smaller and unknown percentage of aggregate defense costs, which we estimate below at 55 percent for med mal cases. We have no data on injury severity, physician specialties, patient gender, or the identities of particular defendants or insurers. We do not know which defendants had excess policies, except when a payout on an excess policy was made, nor policy limits on excess policies.

Uninsured claims and defendants. The TCCD includes only "insured" claims, including claims paid by captive insurers and risk-pooling and risk-retention groups, but not claims paid by "pure" self-insured providers. In particular, we lack data on claims against the University of Texas hospital system and UT-employed physicians.

Defense cost information. We have information on inside counsel cost, outside counsel cost, other loss adjustment expenses (e.g., filing fees, expert witness fees, and the like, collectively, "other expenses"), and total defense cost (the sum of these amounts), but no data on the components of other expense. Some cases have outside counsel expense but zero other expense; for these cases, the outside counsel line may include expenses incurred by counsel and billed to the insurer. For reports with zero defense cost, the reporting patterns are broadly consistent with correct reporting, rather than missing information. For example, 637/1124 (57 percent) of cases resolved before suit is filed have zero reported counsel expense, compared to 266/12,081 (2.2 percent) of cases resolved after suit but before trial, and 6/710 (0.8 percent) of cases that went to trial.[14] In our principal regressions, we

14. Zero reported counsel expense is possible even if counsel is retained, if counsel is paid by another defendant. For the six trials with zero counsel expense, two had counsel expense reported by another defendant, and three had a nonreporting defendant who may have paid counsel.

log-transform dollar values; this drops observations with zero defense costs.[15]

Initial reserves. In 1,016 med mal reports (out of 16,116), the initial indemnity reserve exactly equals the payout. In 390 of these, the initial reserve equals policy limits; in the other 626 cases it does not. There are several reasons why initial reserves might equal payout, other than insurers simply reserving at, and then settling at, policy limits. Insurers may have established the supposedly "initial" reserve only when the case outcome was known, were able to settle for the exact amount of the initial reserve, or misreported to TDI. Because of doubts about timely reserving or accurate reporting, we exclude these 626 cases from regressions that use initial indemnity reserves or initial expense reserves as a variable; we also exclude five cases with initial expense reserve = defense cost $\neq 0$. In robustness checks, we obtain similar results if we include these cases.

County-level variation. In our regressions, we control for time-invariant county-level factors using county fixed effects. In regressions limited to other professional liability cases, to preserve degrees of freedom, we combine observations from counties with a single observation, into a single artificial county. In robustness checks, we obtain similar results without county fixed effects.

Liability caps. Texas adopted a number of tort reforms, including caps on non-economic damages in med mal cases, effective for claims filed after September 1, 2003. These changes largely postdate the period we study, so we cannot assess how they will affect outcomes. There are only fifty-eight post-cap med mal cases in our dataset (0.4 percent of all med mal cases).[16]

15. Prior to 2003, TDI did not verify whether the three expense items summed to total defense cost. Many reports have small discrepancies between the sum of expense items and total defense cost. Some reflect rounding, others appear to be random. The sum across reports of individual expense items for each year nearly equals total defense cost. When studying total defense costs, we rely on reported totals, rather than summing the three expense items.

16. It is not appropriate to exclude these cases, or use a dummy variable to control for them, because they closed much faster than the average case. They thus differ systematically from the remaining cases in ways other than being governed by the 2003 reforms. Excluding or dummying for them could bias our main results.

3.3. Defense Attorney Hourly Rate Information

Beginning in 1989, the Texas State Bar has conducted periodic surveys of hourly rates and other billing practices for Texas lawyers. The methodology varied over time, but we have no reason to expect biases in the results. We rely on these surveys to determine median hourly rates for 1989–2005.[17] The state bar surveys contain aggregate information for the entire period, and information by specialty, including personal injury defense counsel, for 1994–2005.

3.4. Claims Generating Process and Statistical Methodology

Below, we present various regression analyses of time trends and factors that correlate with payouts and defense costs. For med mal cases, our implicit model of the claims generating process is that people have some number Y of medical encounters per year, of which a fraction f lead to a malpractice claim, of which a further fraction p lead to a payout over \$25,000, and hence are included in our dataset.

The number and nature of medical encounters can vary across time. The fractions of these encounters that lead to claims and to payouts can vary across time and with the nature of the encounter, the characteristics of the plaintiff and defendant, and the defendant's insurance coverage. We treat the cases in our dataset as resulting from independent draws from a pool of encounters, each of which produces a claim included in the dataset with probability (fp). We observe Yfp claims in our dataset.

We assume that, apart from a possible time trend, the outcome of each claim is independent of other claims. This assumption will not be strictly true. For defense costs, for example, (i) insurers may adjust their tactics based on prior success or failure; (ii) insurers may have an overall annual or per case budget, so that extra spending on one case predicts lower spending on other cases; (iii) insurers may have a target for how many cases to take to trial or to appeal; and (iv) defense practices may be correlated for particular types of defendants, particular insurers, or both. Any cross-sectional dependence should be partly captured by our year variable. Apart

17. We obtained reports for 1989, 1994, and 1996 from the State Bar. The 2000, 2003, and 2005 reports are at http://www.texasbar.com/template.cfm?section=research_and_analysis.

from the overall time trend toward higher defense costs, there is no evidence of serial autocorrelation in these costs.[18]

The distributions of defense cost, payout, and other dollar variables have a strong positive skew. Residuals from regressions with defense cost or one of its components as the dependent variable are often skewed as well, and thus violate the usual normality-of-errors assumption of ordinary least squares (OLS). Dollar amounts are also bounded at zero and our data include a substantial number of reports with zero defense costs. We therefore take natural logs of dollar variables. The distributions of the logged amounts and regression residuals are respectably close to normal, so OLS and 2SLS regressions should be reasonably well specified.[19]

Taking logs solves a statistical problem at the cost of introducing sample selection bias; for example, cases with zero defense cost are much more likely to have been resolved before a suit is filed. In robustness checks, we obtain similar results if we add $1 to defense cost before taking logs; and then run Tobit regressions to address the stacking of zero defense cost cases at ln($1) = 0; or if we divide the sample into deciles and run ordered Probit regressions, and qualitatively similar results if we do not take logs.

Endogeneity in the relationship among reserves, payout, and defense costs is an important concern. We expect that both payout and defense cost are determined by unobserved case characteristics and that each influences the other (larger expected payout induces larger defense spending; larger defense spending reduces expected payout). We address the endogeneity of payout by using 2SLS regressions, in which we use basic case characteristics (plaintiff age and employment status) as instruments for ln (payout). We discuss instrument validity below.

Endogeneity and omitted variables could affect other relationships as well. For example, the stage at which a claim is resolved predicts defense

18. A Durbin–Watson test failed to reject the null hypothesis of no serial autocorrelation in the detrended yearly means and medians of ln(payout), ln(defense costs), and ratio of defense cost/payout.

19. A Shapiro–Wilk test generally rejects normality of residuals, but visual examination of a kernel density plot, which compares the probability density of the residuals to a normal distribution, indicates only minor deviations from normality for all regressions reported below.

cost—the later the stage, the higher the cost. So does duration. These results may well be causal. Other things equal, a case that goes to trial will cost more to defend than a case that settles before trial. We cannot ascribe causation, however, because unobserved case characteristics could predict both stage of resolution and defense costs. We lack suitable instruments for these variables.

3.5. A Simple Model of Defense Costs

We test a simple model of defense costs. We expect these costs to be a function of:

- Exposure (imperfectly proxied by instrumented payout).
- Case duration (proxied by ln(days claim open)). One might expect attorneys to work more hours, the longer a case remains open.
- Legal procedure. The procedural steps necessary to resolve the case (imperfectly proxied by the stage at which the case is resolved).
- Case complexity (imperfectly proxied by type of case, and whether the case involves multiple defendants).

Our instruments for exposure are crude, and are based only on plaintiff characteristics. Other unobservable factors may either affect exposure or predict defense costs directly. These factors could include the personal characteristics of the plaintiff and defendant, the experience and reputation of their lawyers, and the reputational stakes for the defendant.

We also have data on type of harm (for example, brain damage, multiple injuries, death). In unreported regressions, which include dummy variables for type of harm, a number of types of harm predict defense costs (relative to the omitted "other" category), but we obtain similar results for our principal variables.

4. Defense Costs in Medical Malpractice Cases

4.1. Summary Information on Personal Injury Claims

Table 1 provides summary statistics for the 16,116 med mal claim reports (14,241 nonduplicate cases) in our dataset. The mean (median) defense cost

Table 1. Summary statistics for medical malpractice cases

	Total defense costs	Cost categories: Outside counsel	Inside counsel	Other expenses
All reports	16,116			
Reports with zero defense costs (% of reports)	571 (3.5%)	2,549 (16%)	14,413 (89%)	3,511 (22%)
Reports with positive reported defense costs (% of cases with positive total defense costs)	15,545 (100%)	13,567 (87%)	1,703 (11%)	12,605 (80%)
Nonduplicate cases (defense cost summed across duplicate reports)	14,241			
Cases with zero defense costs (% of all cases)	487 (3.4%)	2,099 (15%)	12,635 (89%)	2,841 (20%)
Cases with positive reported defense costs (% of cases with positive total defense costs)	13,754 (100%)	12,142 (88%)	1,606 (12%)	11,400 (83%)
Mean (median) defense cost	$43,000 ($27,000)	$31,000 ($18,000)	$3,000 ($0)	$10,000 ($4,000)
Percentage of total defense cost	100%	71%	6%	23%

Summary data on closed claim reports, nonduplicate cases, and mean (median) defense costs, for 16,116 med mal claim reports (14,241 nonduplicate cases) closed from 1988–2004 with payout >$25,000 in 1988 dollars. Amounts in thousands of 1988 dollars.

per large paid claim is $43,000 ($27,000). These amounts are comparable to those reported in other studies.[20]

Table 2 provides summary statistics for all five types of cases. Panel A is based on line of insurance. It provides basic claim count and payout information for all claims, including claims closed with payment of $10,000 nominal or less, which are not individually reported. Panel A is limited to 1995–2004, the time period for which aggregate annual reports are available.

20. See Cohen and Hughes (2007) (median defense costs for cases settled before trial over 2000–2004 of $12,000 in Maine, $13,000 in Missouri, $19,000 in Florida, and $29,000 in Texas (also using the TDI database, but a broader dataset—all closed claim reports with payout over $10,000 covered by medical malpractice insurance) (reported in 2004 dollars, converted here to 1988 dollars); Studdert *et al.* (2006) (mean defense costs of $36,000 for cases with positive payout) (reported in 2004 dollars, converted here to 1988 dollars).

Table 2. Summary statistics for all personal injury cases

All panels: Summary data for personal injury claims included in the TDI database of commercially insured personal injury claims. Amounts in thousands of 1988 dollars. Duplicate reports are identified by us (TDI) for med mal (other) cases.

Panel A: All closed claims *by line of insurance* (1995–2004)

Line of insurance	(1) Auto	(2) General commercial	(3) Multi-peril	(4) Other professional liability	(5) Medical professional liability
Total claims	544,640	435,593	190,236	19,816	77,575
% With $0 payout	44.3%	71.5%	60.5%	82.0%	81.9%
% With payout from $1–$25,000	52.3%	26.7%	36.4%	15.4%	6.3%
% Large paid claims (payout ≥ $25,000)	3.4%	1.9%	3.1%	2.6%	11.8%
Mean annual payout on large real claims (as % of total payout)	73.8%	90.2%	86.6%	93.0%	98.7%

Panel A: Data on total claims is available only starting in 1995. Claims are classified based on line of insurance. Duplicate claims are excluded for individually reported claims (payout >$10,000 nominal).

Panel B: Large paid claims *by type of case*

Type of case	Auto	General commercial	Multi-peril	Other professional liability	med mal
Claim reports	32,062	18,164	12,024	1,001	16,116
Nonduplicate cases	31,933	17,592	11,594	972	14,241
Mean defendants per case	1.24	1.87	1.75	1.92	2.41
Mean (median) days claim open	831 (734)	1,008 (904)	896 (803)	873 (719)	923 (807)
Suit filed (%)	67%	87%	82%	90%	92%
Nonzero defense costs (%)	76%	89%	85%	92%	96%
Cases with full trial (%)	2.7%	3.0%	3.0%	3.1%	2.7%

Panel B. Summary data for personal injury claims closed from 1988–2004 with payout > $25,000 in 1988 dollars. All rows except total claim reports exclude duplicate reports.

(*continued overleaf*)

Table 2. (*Continued*)

Panel C: Payouts, defense costs, and reserves for large paid claims *by type of case*

Type of case	Auto	General commercial	Multi-peril	Other professional liability	med mal
Payout and indemnity reserve data					
Mean (median) total payout	$154($60)	$253($77)	$199($66)	$193($63)	$322($134)
Mean (median indemnity reserve	$43($9)	$51($14)	$41($13)	$40($16)	$64($32)
Defense cost and expense reserve data					
Mean (median) defense cost	$12($4)	$28($13)	$21($10)	$26($14)	$38($25)
Mean (median) expense reserve	$2($0)	$6($0)	$4($0)	$7($3)	$10($6)
Mean (median) expense reserve/indemnity reserve	57% (23%)	80% (39%)	80% (35%)	69% (40%)	53% (27%)
Mean (median) defense cost/(payout by this insurer)	15% (5%)	41% (18%)	32% (14%)	40% (23%)	45% (22%)
Aggregate (defense cost/payout)	10%	21%	19%	23%	20%
Outside/total counsel expense	95.0%	96.5%	94.0%	95.7%	92.3%

Summary data for nonduplicate reports for claims closed from 1988–2004 with payout >$25,000 in 1988 dollars. Total payout is total payments by all defendants; defense costs are those shown on the primary report (not summed across duplicate reports). Defense cost/(payout by this insurer) excludes 1,665 cases with zero payout and 3 cases with $1 payout. Expense reserve/indemnity reserve excludes 44,162 cases with expense reserve <$1,000; indemnity reserve <$1,000, or (expense reserve/indemnity reserve) <0.02 or >50.

As panel A indicates, only 18 percent of med mal and other professional liability cases result in a positive payout, compared to 28 percent for general commercial, 39 percent for multi-peril, and 56 percent for auto cases. However, med mal payouts are more likely to be large (over $25,000). Large payouts are 65 percent of paid claims versus 6–14 percent in other areas.

Panels B and C are based on type of case, and provide more details on large paid claims. Med mal cases average 2.4 defendants per claim, more than the other types of cases; have the highest payouts; and are the most expensive to defend in raw dollars. However, they are similar to general commercial, multi-peril, and other professional liability cases in the ratio of

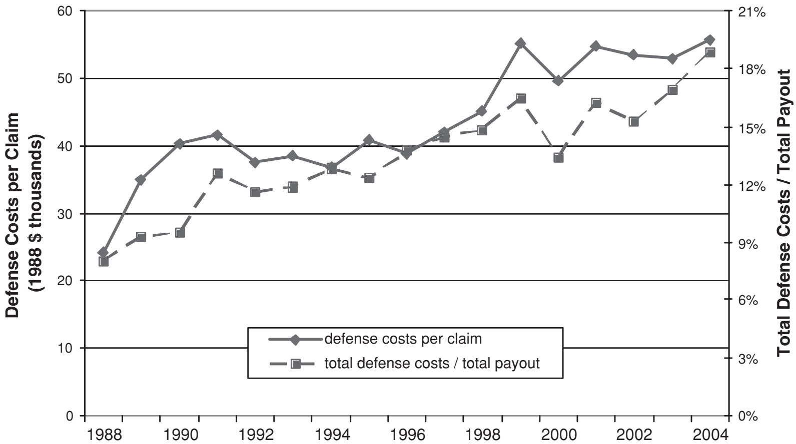

Figure 1. Time trends in medical malpractice defense costs. Mean annual defense cost per claim and annual ratio of total defense costs to total payout for 13,754 nonduplicate med mal cases with positive defense costs closed from 1988–2004 with payout >\$25,000 in 1988 dollars. Payout is total payments by all defendants; defense costs are summed across duplicate reports relating to the same claim. Amounts in thousands of 1988 dollars.

defense costs to payout. Med mal cases are more likely to be resolved after a suit is filed, and more likely to involve positive defense costs.[21] On all these measures, auto cases are the least complex type of litigation.

4.2. Time Trends, Payouts, and Other Predictive Factors in Medical Malpractice Cases

A central finding of this study is that defense costs rose substantially over our sample period, even though payouts showed no time trend. Figure 1 provides an initial, visual picture. Both real defense costs and the ratio of defense costs to payout roughly doubled, with total defense costs rising from 8.0 percent of total payout in 1988 to 18.9 percent in 2004.

Table 3 uses OLS regression analysis to explore which factors predict defense spending. The dependent variable for regressions (1–5) is ln(defense cost). Regression (1) reports the unconditional time trend in payouts. Regression (2) reports the trend conditioned only on ln(payout). Regressions

21. All statements in this paragraph about differences reflect significant differences at $P = 0.05$, based on a t-test for difference in means.

Table 3. Factors predicting medical malpractice defense costs

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable			ln(defense cost)			Defense cost/ (defense cost + payout)
Year	**0.046**	**0.046**	**0.045**	**0.052**	**0.051**	**0.006**
	(19.95)***	**(21.94)*****	**(25.39)*****	**(31.46)*****	**(31.36)*****	**(27.49)*****
ln(payout)		**0.452**	**0.349**	**0.355**	**0.354**	**−0.079**
		(49.50)***	**(42.92)*****	**(47.43)*****	**(47.47)*****	**(−79.83)*****
Dummy (suit filed)			**2.490**	**1.893**	**1.898**	**0.126**
			(47.23)***	**(35.87)*****	**(35.59)*****	**(32.73)*****
Dummy (trial started)			**0.741**	**0.579**	**0.580**	**0.078**
			(17.39)***	**(13.86)*****	**(13.90)*****	**(11.18)*****
Dummy (full trial)			0.062	−0.018	−0.018	0.001
			(1.00)	(−0.29)	(−0.30)	(0.05)
Dummy appeal			**0.350**	0.095	0.088	0.021
			(4.23)***	(1.16)	(1.09)	(1.42)
Dummy multiple defendants			**0.24**	**0.181**	**0.178**	**0.026**
			(13.31)***	**(10.94)*****	**(10.47)*****	**(11.79)*****
Duration				**0.711**	**0.711**	**0.077**
				(40.22)***	**(40.04)*****	**(40.75)*****
Physician dummy ($n = 10{,}077$)					−0.031	
					(−0.75)	
Hospital dummy ($n = 2{,}041$)					0.011	
					(0.23)	
Nursing home dummy ($n = 990$)					−0.056	
					(−1.07)	
Constant	9.674	4.278	2.988	−1.281	−1.249	0.433
	(407.33)	(37.73)	(28.26)	(−8.84)	(−8.37)	(29.09)
Sample size	13,754	13,754	13,754	13,754	13,754	14,241
Overall adj. R^2	0.029	0.181	0.430	0.522	0.522	0.464

Regressions of ln(defense cost) and ratio of defense cost to (defense cost + payout) on indicated independent variables for 14,241 nonduplicate med mal cases (regressions (1–5) are limited to 13,754 cases with positive defense costs) closed from 1988–2004 with payout >$25,000 in 1988 dollars. Payout is total payments by all defendants; defense costs are summed across duplicate reports relating to the same claim. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Significant results at 5% or better in **boldface**.

(3)–(5) progressively add additional control variables. In regression (6), we switch to the ratio of defense cost to total cost (payout + defense cost) as the dependent variable, with similar results to regression (4). We discuss the results briefly below, but caution that several variables are endogenous. We defer additional discussion until after we instrument for ln(payout):

- *Year*. The unconditional rise in defense costs is 4.6 percent per year. This coefficient is stable if we control for payout (regression (2)) and other claim and outcome variables (regression (3)). The coefficient increases to 5.1 percent per year in regression (5) with full control variables; this reflects the trend toward claims closing more quickly over time (see table 12).
- *Ln(payout)*. We expect insurers to spend more to defend cases with larger exposure. Payout is an endogenous proxy for exposure. A 1 percent increase in payout predicts a 0.35–0.45 percent increase in defense cost, depending on specification. Thus, while larger cases cost more, defense costs rise less than proportionately with payout. We test for and do not find significant nonlinearity in the log-log relationship between defense cost and payout.
- *Case complexity*. As measures of case complexity, we include a multi-defendant dummy (= 1 if two or more defendants, 0 otherwise). This variable is positive and significant, but changes sign and loses significance when we instrument for payout in table 4.
- *Resolution stage*. We include a family of dummy variables, which equal 1 if a case reaches a particular stage (such as a suit being filed), 0 otherwise. Defense cost rises if a suit is filed, and if a trial is begun, but there is no significant additional cost if trial is completed, versus simply begun. Cases that are appealed cost more than cases that are tried but not appealed (regression (3)), but the appeal dummy becomes insignificant when we control for duration in regression (4).
- *Duration*. A plausible factor that can affect defense cost is claim duration, which we measure as ln(days a claim is open). (A case begins the day the claim is reported to the insurer, and ends the day the insurer closes the claim. This allows us to use the same measure of case duration for cases where suit was and wasn't filed). Duration is strongly related to defense cost, as expected. In robustness checks, we obtain similar results using ln(days from injury to claim closing) to measure duration.

- *Type of defendant dummies*. In regression (5), we add type-of-defendant dummies for the primary defendant (physician, hospital, or nursing home; "other" is the omitted category). Our dataset includes 10,077 (2,041) (990) cases with a physician (hospital) (nursing home) as primary defendant. These variables are all insignificant.

These results, with higher defense cost the larger the payout, the longer a case lasts, and the later the stage at which a case is resolved, are plausible. Still, we cannot infer causation, because unobserved factors could predict both defense cost and various independent variables, and because defense cost could affect payout.

4.3. Instruments for Payout in Medical Malpractice Cases

Payout and defense cost are likely to be jointly and endogenously determined. In this section, we develop and justify several instruments for payout. Instrumented payout can be seen as a measure of (unobserved) exposure—the potential payout that an insurer might expect, given an average level of defense spending.

A valid instrument for payout must be exogenous (not influenced by defense cost), correlate with payout, and predict defense cost only indirectly, by predicting payout. Some simple case characteristics—plaintiff age and employment status—satisfy the first two criteria. Moreover, it is plausible that they predict defense cost only or primarily through their effect on payout. Table 4 presents a 2SLS analysis, using a set of "basic instruments": ln(age in years + 1) (we add 1 to avoid losing baby cases, with age = 0), baby dummy, and employed dummy.

Assuming valid instruments, we can use a Durbin–Wu–Hausman test (described in Wooldridge, 2008, pp. 532–3) to assess whether there is endogeneity. This test strongly rejects the exogeneity of ln(payout) and ln(defense cost) ($\chi^2 = 74$, $P = 0.0000$). Assuming at least one valid instrument, we can use the Hansen (1982) test of over-identifying restrictions to test the joint acceptability of all three instruments. Our instruments pass the Hansen test ($\chi^2 = 0.002$, $P = 0.999$). Again assuming one valid instrument, we can test the acceptability of other instruments using a "difference in Hansen" test; all three instruments pass this test with P values above 0.98.[22]

22. The Hansen test is a heteroskedasticity-consistent extension of the earlier Sargan (1958) test. It is distributed χ^2 (n, w), where n = degrees of freedom and w =

Table 4. 2SLS analysis of medical malpractice defense costs

Regression type	2SLS		2SLS		IV Tobit
Regression	(1)		(2)		(3)
Stage	1st	2nd	1st	2nd	2nd
Dependent variable	ln(payout)	ln(def. cost)	ln(payout)	ln(def. cost)	ln(def. cost+1)
Year	**0.004**	**0.047**	**0.004**	**0.051**	**0.056**
	(2.03)**	**(20.01)*****	**(2.06)****	**(29.03)*****	**(18.21)****
Exposure (instrumented ln(payout))		**0.972**		**0.700**	**0.695**
		(18.95)***		**(15.56)*****	**(8.78)****
Dummy (suit filed)			**0.351**	**1.777**	**3.442**
			(9.18)***	**(32.44)*****	**(48.32)****
Dummy (trial started)			**0.359**	**0.459**	**0.533**
			(6.09)***	**(9.45)*****	**(5.29)****
Dummy (full trial)			0.145	−0.063	−0.202
			(1.66)*	(−0.94)	(−1.43)
Dummy appeal			**0.545**	−0.108	−0.162
			(3.72)***	(−1.06)	(−0.80)
Dummy multiple defendants			**0.561**	−0.028	−0.034
			(30.78)***	(−0.87)	(−0.60)
ln(days claim open)			**−0.063**	**0.722**	**0.952**
			(−3.81)***	**(39.44)*****	**(37.36)****
Type of defendant dummies	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Instruments for ln(payout)					
ln(age + 1)	**−0.136**		**−0.117**		
	(−8.96)***		**(−8.07)*****		
Baby dummy	0.123		**0.139**		
	(1.88)*		**(2.22)****		
Employed dummy			**0.042**		
			(2.14)**		
Overall adj. R^2	0.037	−0.033	0.115	0.432	pseudo = .152
Endogeneity tests (p value)					
χ^2 for endogeneity		144		74	
		(0.0000)		(0.0000)	
Hansen χ^2		1.5		0.002	
		(0.22)		(0.999)	

(*continued overleaf*)

Table 4. (*Continued*)

Regression type	2SLS		2SLS		IV Tobit
Regression	(1)		(2)		(3)
Stage	1st	2nd	1st	2nd	2nd
Dependent variable	ln(payout)	ln(def. cost)	ln(payout)	ln(def. cost)	ln(def. cost+1)
Difference in Hansen tests					
C-stat (ln(age + 1)				0.001	
				(0.98)	
C-stat (baby dummy)				0.001	
				(0.98)	
C-stat (employed)				0.001	
				(0.98)	

Two-stage least squares regressions of ln(defense cost) on indicated independent variables for 14,241 nonduplicate med mal cases closed from 1988–2004 with payout >$25,000 in 1988 dollars. Payout is total payments to the plaintiff by all defendants; defense costs are summed across duplicate reports relating to the same claim. Regressions (1) and (2) are limited to 13,754 cases with positive defense costs. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively. Significant results at 5% or better in **boldface**.

The validity of all three instruments rests on similar logic that simple case characteristics should predict defense costs primarily (ideally only) indirectly, by predicting exposure. That each passes the difference in Hansen test, assuming the validity of one or both of the others, provides support for this underlying logic.

Several softer indicators are consistent with the reasonableness of our instruments. First, we expect higher defense spending to predict lower payout. Thus, instrumented payout should correlate more strongly with defense cost than raw payout. This is what we find. Second, if these instruments are valid, the coefficient on instrumented payout should not depend on which we use. In unreported robustness checks, we verify that the coefficients on instrumented exposure are similar if we use of any one of these instruments, any two of them, or all three. Third, we obtain similar results in robustness checks using alternate or additional instruments (see next section).

(number of instruments – number of instrumented variables). It is reported in the user-developed ivreg2 and xtivreg2 add-ons to Stata in heteroskedasticity-consistent specifications (robust, cluster, or gmm options). The difference-in-Hansen test (often confusingly called a difference-in-Sargan test) is described in Baum, Schaffer, and Stillman (2003), and is based on the difference between the Hansen χ^2 values with and without a particular instrument. It is available in the ivreg2 and xtivreg2 add-ons to Stata, using a heteroskedasticity-consistent specification with the orthog option.

Hersch and Viscusi (2007) use indemnity reserves to proxy for expected exposure. They claim that indemnity reserves are exogenous, but do not test this assertion. We find that indemnity reserves are strongly endogenous. For example, in a regression similar to table 4, regression (2), adding ln(indemnity reserve) as an additional instrument for ln(payout) produces a difference-in-Hansen value (C-statistic) of 85 ($P = 0.0000$). The endogeneity of reserve estimates should not be surprising. Initial reserves are estimates of final amounts. If the final amounts are endogenous, the initial estimates are likely to be as well.

4.4. Payouts and Other Predictive Factors in Medical Malpractice Cases: 2SLS Results

4.4.1. Basic instruments. Table 4 presents 2SLS results for med mal cases, using our basic instruments. We first consider regression (2), which is similar to the full controls regression (5) in table 3. The coefficient on year is unchanged. The coefficient on ln(payout) roughly doubles, from 0.35 in OLS to an 0.70 coefficient on instrumented ln(payout) in 2SLS. The large difference in coefficients is consistent with strong endogeneity. The coefficient remains less than one, consistent with economies of scale in litigation, controlling for the stage at which a case is resolved. A ten-fold increase in exposure predicts a five-fold increase in defense spending.

The other major change between our OLS and 2SLS results involves the multiple defendants dummy. Hersch and Viscusi (2007) argue that defense costs are affected by both case scale and case complexity. They use a multiple defendants dummy to proxy for complexity, find a significant positive coefficient, and conclude that case complexity predicts higher defense costs, separate from financial exposure. We also find that this variable is positive and significant in OLS, in table 3. However, in 2SLS, the coefficient on multiple defendants dummy changes sign and becomes insignificant.

Regression (1) uses a simpler specification, similar to the OLS results in table 3, regression (2), with only year, instrumented ln(payout), and type of defendant dummies as independent variables in the second stage. We drop employment dummy as an instrument, since it is only marginally significant in the first stage and barely passes a difference in Hansen test (C-stat $= 3.79$, $P = 0.052$), but results are similar if we use it as an additional instrument. In this simpler specification, the coefficient on year is close to 1, indicating no significant scale economies in defending med mal cases. Scale economies are evident only once one controls for the stage at which the case is resolved. The larger coefficient on exposure, compared to the full controls results in regression (2), reflects a tendency for larger to cases settle more slowly (see table 12) and at a later stage.

Cases in which suit is filed are far more costly to defend than cases that are resolved before suit. About half of the settlements before suit is filed have zero defense costs, and thus are dropped from in table 4. Even so, settlement after suit but before trial predicts higher defense spending by a factor of $e^{1.78} = 5.9$, relative to settlement before suit is filed, holding constant the length of time the case is open. Since cases in which suit is filed usually last longer, the overall predictive effect of a filed lawsuit is even greater. We caution, however, that one cannot assess the extent to which suit filing *causes* higher defense spending. There are likely to be unobservable differences between cases in which suit is and is not filed.

Starting a trial predicts a further rise in defense spending, by a factor of $e^{0.46} = 1.58$, again holding constant time to closing. However, there is no significant difference in spending between cases settled during trial and cases in which trial is completed. Potential explanations include: (i) most defense spending could involve preparing for trial, so that the savings if a settlement is reached mid-trial is not significant; (ii) med mal trials are often short, so "in-court" time savings may be modest; (iii) some settlements could be after the trial is entirely or mostly completed, but before the jury returns a verdict; and (iv) cases which settle before verdict could be simpler than those which go to a verdict.

Duration strongly predicts defense costs. Holding resolution stage constant, a 1 percent increase in days open predicts an 0.72 percent increase in defense costs. If we remove ln(days claim open) as an independent variable, then cases which are appealed cost more to defend than cases that are not appealed, both in OLS (table 3, regression (3)) and in 2SLS (not reported), but the coefficient on appeal dummy is insignificant when duration is included.

In regression (3), we switch to ln(defense cost + 1) as dependent variable, and to IV Tobit as the regression methodology. The coefficient on year rises to 5.6 percent; the coefficient on exposure is very similar to 2SLS. We obtain similar coefficient on year and exposure in unreported 2SLS regressions using ln(defense cost + 1) as the dependent variable. We also obtain a similar coefficient on year in unreported ordered probit regressions in which we divide the sample into deciles based on defense cost; an instrumental variable version of order probit is not available.

In unreported 2SLS regressions, we examine the extent to which year and exposure predict defense costs in regressions limited to a single type of primary defendant (physician, hospital, nursing home). In regressions similar to regression (2), the coefficient on year is 5.4 percent for physicians (for which payout declines by 0.4 percent per year); 4.5 percent for hospitals (for which payout rises at 2.4 percent per year), and –0.9 percent per year for nursing homes (for which payout rises 5.6 percent per year).

4.4.2. Alternate instruments. In unreported regressions, we investigate several alternate instruments for payout. Policy limits are a plausible additional proxy for exposure. If we add ln(policy limits) as an additional instrument in table 4, regression (2), ln(policy limits takes a C-stat of 3.5 ($P =$ 0.06) and the coefficient on instrumented ln(payout) declines from 0.700 in table 4 to 0.637 ($t = 21.65$). However, in other specifications, ln(policy limits) often fails a difference-in-Hansen test. For example, in a regression similar to table 4, regression 1, ln(policy limits) takes a C-stat of 22 ($P =$ 0.0000). We therefore do not use this instrument.

Type-of-harm dummy variables (death, brain damage, burns, and the like) are also potential instruments for payout. The risk for instrument validity is that type of harm is associated with case complexity (brain damage is complicated to evaluate, perhaps; while death is simple), and thus may predict defense cost both indirectly through exposure, and directly by proxying for complexity (controlling for exposure). In a specification similar to table 4, regression (2), brain damage dummy strongly fails a difference-in Hansen test (C-stat = 26, $P = 0.0000$); as do burns (C-stat = 8.55, $P = .003$), but most other injury types have low C-stats—for example, death dummy (C-stat = 0.44, $P = 0.51$); spinal cord dummy (C-stat = 3.0, $P = 0.08$); and eye injury (C-stat = 0.73, $P = 0.39$). In robustness checks, we use as instruments the type-of-harm dummies, which significantly predict ln(payout) in the first stage and pass a difference-in-Hansen test, either in addition to or instead of our preferred instruments. The coefficients on instrumented payout vary only slightly from those shown in table 4.

4.5. Components of Defense Costs in Medical Malpractice Cases

Figure 2 shows the components of defense spending by year. Overall, legal expenses average 77 percent of total defense cost (see table 1). In

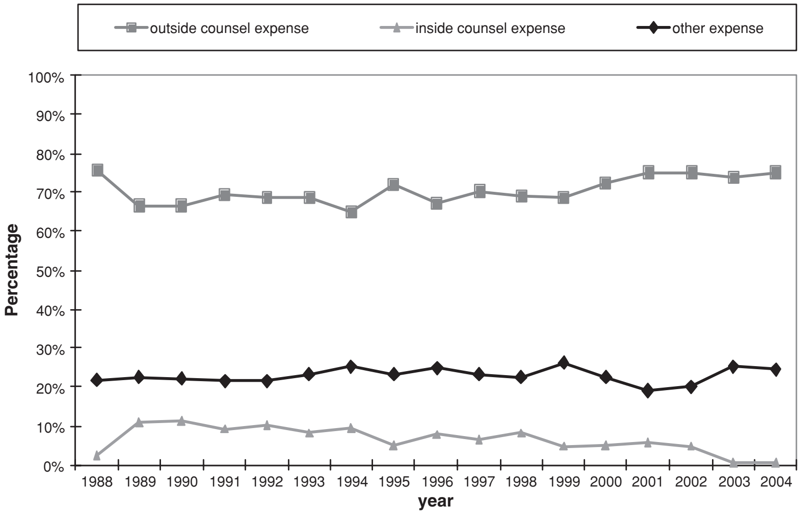

Figure 2. Medical malpractice cases: components of total defense cost. Annual outside counsel expense, inside counsel expense, and other loss adjustment expense, as percentage of total defense cost for 14,241 nonduplicate med mal cases closed from 1988–2004 with payout >$25,000 in 1988 dollars. Defense costs are summed across duplicate reports relating to the same claim.

unreported regressions, we find no time trend in this percentage. "Other expense," including expert witness costs, accounts for the balance of defense cost. Inside counsel expense is negligible in 1988, rises sharply in 1989, declines gradually over 1989–2002, and again becomes negligible in 2003. There is a similar rise in the number of cases going solely to inside counsel from 11 in 1988 to 79 in 1989 and 122 in 1990; and then a sharp drop from 107 in 2001 and 92 in 2002 to only 9 in 2003 and 13 in 2004.

What might produce this pattern? We were reliably advised that insurers covering a substantial majority of Texas physicians never rely on inside counsel. TDI also confirmed that the jump in reliance on inside counsel in 1989, and the drop in 2003, reflect one insurer changing in the mid-1980s from relying primarily on outside counsel to fully or partly relying on inside counsel, and then returning around 2000 to relying primarily on outside counsel.

Insurers rarely use both inside and outside counsel in the same case. Only 176/16,116 reports (1.1 percent) involve positive expense for both inside and outside counsel. For cases that go to trial, only 0.6 percent [4/723 reports] involve positive expense for both inside and outside counsel.

5. Insurer Reserving Practices in Medical Malpractice Cases

5.1. Case-Level Expense Reserves

TDI requires insurers to report initial and final reserves for both payout and defense costs. We study only initial reserves here. Below, we often drop the term "initial" in referring to reserves. TDI provides no instructions on when the initial reserve should be established. Industry participants advised us that there are no industry standards for when initial reserves are set and that practice could well vary, both across insurers and across claims adjusters for a single insurer. We assess how well case-level initial reserve predict case-level variation in actual defense cost.

Assume that when they set initial setting reserves, insurers have access to the basic case characteristics included in closed claim reports, plus additional information unavailable to us, such as defendant physician specialty, case-specific facts that affect the likelihood that negligence will be found, and injury severity. Assume as well that insurers use past experience to estimate defense costs, perhaps using a regression analysis similar to the one we present below. We might then expect that:

- case-level variation in expense reserves will have substantial power (measured by adjusted R^2) to predict case-level variation in defense costs, and should outperform naive estimates based only on basic case characteristics;
- insurers will extract the useful information from basic case characteristics, so that in a regression which uses both insurer reserves and basic case characteristics to predict defense costs, case characteristics will lose much of their predictive power;
- in a simple regression of ln(defense cost) on ln(expense reserve), the coefficient on ln(expense reserve) should be close to 1; and
- the factors that predict defense costs should also predict expense reserves.

We find none of these things. Variation in case-level expense reserves predicts variation in actual defense costs quite poorly. Basic claim

Table 5. Medical malpractice cases: predicting defense costs

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable			Ln(defense cost)			Ln(expense reserve)
Year			**0.048**	**0.048**	**0.051**	**−0.018**
			(21.81)***	**(22.33)*****	**(23.77)*****	**(8.72)*****
ln(age + 1)			**−0.126**	**−0.108**	**−0.112**	0.008
			(−17.40)***	**(−7.00)*****	**(−7.31)*****	(0.53)
Baby dummy				**−0.152**	**−0.138**	0.019
				(−2.40)**	**(−2.20)****	(0.31)
Employed Dummy				**0.119**	**0.133**	**−0.102**
				(5.23)***	**(5.91)*****	**(5.01)*****
ln(indemnity reserve)		**−0.033**			**−0.069**	
		(−3.97)***			**(−8.51)*****	
ln(expense reserve)	**0.135**	**0.149**			**0.166**	
	(12.39)***	**(12.90)*****			**(14.71)*****	
Type of injury dummies	No	No	No	Yes	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Sample size			13,017			13,341
Adj. R^2	0.014	0.016	0.051	0.093	0.112	0.008

Regressions of ln(defense cost) on indicated independent variables for 13,017 med mal claim reports (including duplicate reports) with positive expense reserves closed from 1988–2004 with payout >$25,000 in 1988 dollars, excluding cases with (i) expense reserve = defense cost or (ii) (indemnity reserve = payout but ≠ policy limits). Regressions (1)–(5) are limited to cases with positive defense cost. Defense cost is amount paid the insurer filing the report. Payout is amount paid by the insurer, the primary defendant, and any excess insurer for that defendant. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively. Significant results at 5% or better in **boldface**.

characteristics do much better at this, so the task is not impossible. And the factors that predict defense costs either are insignificant predictors of expense reserves, or have the wrong sign.

Table 5 presents some evidence on insurer accuracy in reserving for defense costs. In regression (1), a simple regression of ln(defense cost) on ln(expense reserve) plus a constant term, expense reserve is positive and significant, but the adjusted R^2 for the regression is only 0.014. Moreover, the coefficient on ln(expense reserve) is only 0.135—implying that a 1 percent increase in expense reserves predicts only a 0.14 percent increase in defense costs. Adding ln(indemnity reserve) in regression (2) scarcely helps; adjusted R^2 improves only to 0.016. We obtain even lower values if we add $1 to reported defense costs before taking logs, thus including observations with zero defense costs; adjusted R^2 in regression (2) falls to

0.007. This suggests that insurers either do not know much about case-level variation in expected defense costs when they establish initial reserves, or do not fully use the information they have.

In regressions (3)-(4), we assess how well one could do at case-level prediction, using basic claim characteristics that are available to insurers early in the claim-handling process. Regression (3) includes only year claim closed, ln(age+1), and a constant term as independent variables. The adjusted R^2 is 0.051—not high, but a substantial improvement over the R^2 values using expense reserves alone. [23]

In regression (4), we add our other instruments (baby dummy and employed dummy) plus type of harm dummies. Adjusted R^2 improves to 0.093. Thus, basic claim characteristics outperform insurer expense reserves in predicting case-level variation in defense costs.

In regression (5), we add both ln(indemnity reserve) and ln(expense reserve) as additional independent variables. Adjusted R^2 improves again to 0.112, but the coefficient on year and plaintiff characteristics scarcely change. This suggests that expense reserves is capturing different aspects of expected defense costs than these variables, and is likely not capturing much of the information embedded in these variables.

In regression (6), we assess whether year of closing and our basic instruments predict expense reserves. Based on regression (4), where we predict defense costs, we expect a positive coefficient on year and employed dummy, and negative coefficients on baby dummy and ln(age+1). We find instead that year and employed dummy have negative signs, and plaintiff age has no predictive power. Med mal insurers not only failed to raise their expense reserves over time, to correspond to rising defense costs, they reduced them! Adjusted R^2 is quite low, at 0.008, and improves only slightly to 0.017 if

23. Our [0] use of year of closing requires explanation. Insurers set initial reserves when a claim is opened, not when it is closed. However, using claim-opening year as an independent variable create a sample selection problem. For early years, we observe only long-lived cases, which closed in 1988 or later. For later years, in contrast, we observe only short lived cases, which closed by 2004. Using the closing year avoids this problem—we have a complete set of all cases that closed in each year from 1988 through 2004. One can understand closing year as a proxy for opening year, which avoids sample selection issues. In robustness checks using opening year, we obtain similar results but lower adjusted R^2.

we add type of injury dummies. Thus, the factors that predict defense costs either do not predict expense reserves or do so with the opposite sign.

A possible explanation for both the weak power of reserves to predict defense costs, and med mal insurers' failure to increase their expense reserves to reflect rising defense costs is that insurers apply a rule of thumb on the expected ratio of defense costs to payout and have not updated this rule of thumb. We asked several med mal insurers whether they use rules of thumb in establishing expense reserves. The more common answer was that reserves are established on a case-by-case basis. One replied that "A very good rule of thumb among med mal insurers is [that defense costs equal] about half of indemnity." However, this is a rather larger thumb than Texas med mal insurers appear to use.

Our data also suggest that insurers do not set expense reserves simply as a fraction of indemnity reserves, In a regression of ln(expense reserve) on ln(indemnity reserve) and a constant term, the coefficient on ln(indemnity reserve) is 0.37 ($t = 58.07$). If defense reserves were often set as a fraction of indemnity reserves, this coefficient ought to be close to 1.

5.2. Aggregate Expense Reserves

Even if med mal insurers do not accurately reserve for defense costs in individual cases, they might still do a good job of estimating their aggregate exposure. They do not appear to do so. Figure 3 shows a smoothed three-year average ratio of aggregate indemnity reserves to aggregate payouts; the ratio of aggregate expense reserves to aggregate defense costs; and the ratio of the two aggregate reserves.[24]

As defense costs increase over 1988–2004, the ratio of aggregate expense reserves to aggregate defense costs declines, from an average of 35 percent during 1988–1992 to only 22 percent during 2000–2004. In contrast, the ratio of aggregate indemnity reserves to aggregate payouts varies much less and shows no overall time trend. Over the full period, the ratio of defense cost to payout roughly doubled. Yet the ratio of expense reserve to indemnity

24. We use smoothing to reduce the impact of outlier payments. For 1990–2004, we give 50 percent weight to the most recent year, 33 percent to the prior year, and 17 percent to two years prior. For 1989, we give two-thirds weight to 1989 and one-third weight to 1988. For 1988, we give 100 percent weight to 1988. The graph is visually similar with equal weighting of the most recent two or three years, and two-year smoothing with two-thirds weight to most recent year.

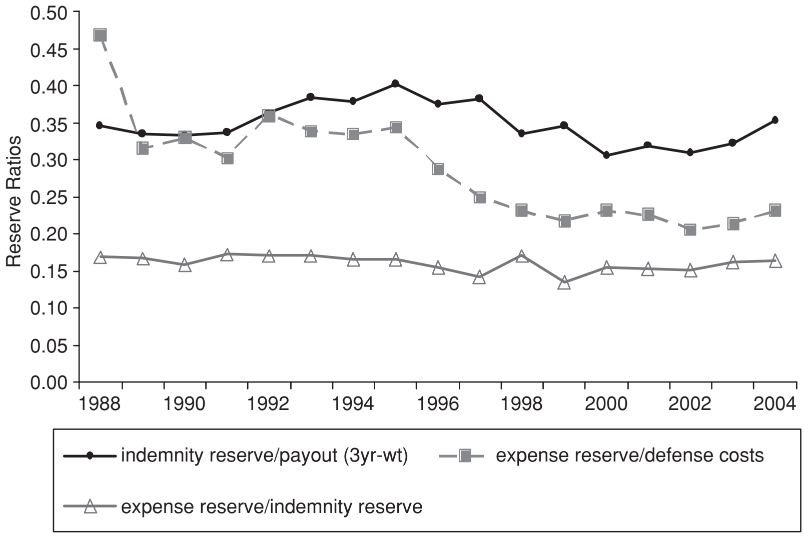

Figure 3. Medical malpractice cases: aggregate reserves over time. Figure shows three lines: (i) three-year smoothed ratio of (indemnity reserve)/(primary insurer payout), (ii) annual ratio of (expense reserve)/(primary insurer defense cost), and (iii) annual ratio of indemnity reserve/expense reserve, for 16, 116 med mal claim reports (including duplicate reports) closed from 1988–2004 with payout >$25,000 in 1988 dollars. Smoothed ratio gives weight of 50% to most recent year, 33% to prior year, 17% to two years prior.

reserve remained relatively constant, averaging 16.7 percent during 1988–1992, and 15.7 percent during 2000–2004.

Figure 4 shows in a different way the failure of med mal insurers to adjust expense reserves to reflect rising defense costs. It presents mean defense costs and initial reserves by year, normalized to their respective means during 1988–1990. Defense costs rise steadily, while reserves are roughly flat. We obtain similar results for medians.

Table 6 turns to regression analysis of changes over time in the ratio of reserves to insurer payments. We exclude outlier reports in which the dependent variable has a small numerator or denominator (indemnity reserve, expense reserve, or expenses <$1,000, or payout <$10,000), or is very small (<0.02) or large (>50). In regression (1), consistent with figure 3, there is no significant time trend in the ratio of indemnity reserves to payouts. In contrast, regression (2) shows a strong 6 percent annual decline in the ratio of expense reserves to defense costs. As regression (3) indicates, even

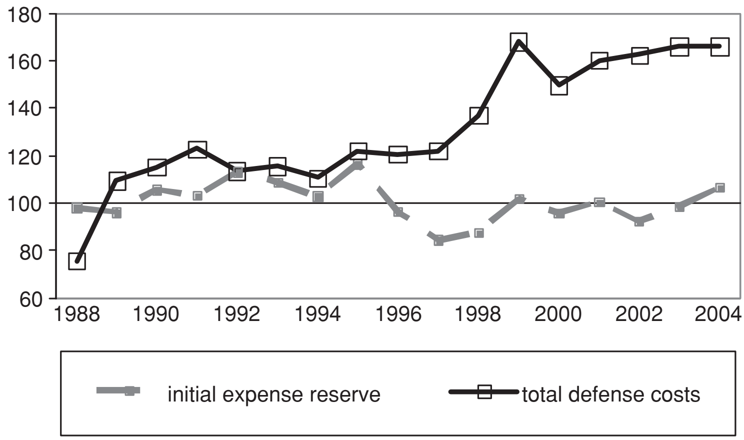

Figure 4. Medical malpractice cases: normalized mean defense costs and initial reserves. Figure shows: (i) mean per case initial expense reserves for each year, and (ii) mean per claim defense costs, in each case normalized to 100 over 1988–1990, for 16,116 med mal claim reports (including duplicate reports) closed from 1988–2004 with payout >$25,000 in 1988 dollars.

Table 6. Medical malpractice cases: insurer reserves over time

	(1)	(2)	(3)	(4)
Dependent variable	ln(indemnity reserve/payout)	ln(expense reserve/ defense costs)	ln(expense reserve/ indemnity reserve)	ln(expense reserve)
Year	−0.0016	**−0.057**	**−0.021**	**−0.017**
	(−0.68)	**(−23.12)*****	**(−13.20)*****	**(−9.07)*****
ln(indemnity reserve)			**−0.629**	**0.282**
			(−98.18)***	**(27.89)*****
Constant	−1.196	−0.671	5.337	6.104
	(−50.60)	(−27.28)	(79.56)	(58.55)
Sample size	13,771	11,840	12,095	12,982
Overall adj. R^2	0.0000	0.0456	0.4471	0.1326
Cuzick test for trend	−1.63	**−24.31*****	**−11.23*****	**−12.24*****
(*P*-value)	(0.103)	**(0.000)**	**(0.000)**	**(0.000)**

Regressions of indicated ratios of insurers' indemnity and expense reserves to actual payments and defense costs, for 16,116 med mal claim reports (including duplicate reports) closed from 1988–2004 with payout >$25,000 in 1988 dollars, excluding cases with (i) expense reserve = defense cost; (ii) (indemnity reserve = payout but ≠ policy limits); or (iii) as applicable for dependent variable, indemnity reserve, expense reserve, or expenses <$1,000, payout <$10,000, or ratio variable very small (<0.02) or large (>50). Defense cost is amount paid by the insurer filing the report. Payout is amount paid by the insurer, the primary defendant, and any excess insurer for that defendant. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Cuzick test statistic is a z-statistic. Significant results at 5% or better in **boldface**.

though the ratio of defense cost to payout *doubled* over our time period, the ratio of expense reserve to indemnity reserve *declined* by about 2 percent per year. In the last row, we confirm the significance of the negative trends in regressions (2)–(5) using Cuzick's (1985) nonparametric test for trend.

In regression (4), we switch from ratios to ln(dollars). Controlling for indemnity reserve, expense reserves declined over a 16-year period in which actual defense costs doubled. The negative coefficient on year is consistent with the negative coefficient in table 5, regression (6).

6. Comparing Medical Malpractice to Other Personal Injury Litigation

The Texas database includes closed claim reports for bodily injury covered by five lines of commercial insurance: med mal, general commercial, auto, multi-peril, and other professional liability. We consider in this section the extent to which the factors that predict defense costs and expense reserves are similar across these five areas. Table 2 provides summary statistics for each area.

6.1. Overview of Defense Costs Across Areas

Figure 5 provides an overview of how median defense costs vary with stage of resolution and across area. Results for mean defense costs are similar. Across areas, claims that are settled before suit is filed are far cheaper to defend. Once a suit is filed, expected cost jumps. The likelihood that the insurer will retain counsel jumps as well, in unreported probit regressions. There is another jump in cost for cases that go to trial. Similar to med mal, there is no significant difference between cases in which trial was started and cases with a completed trial but no appeal. Appealed cases are more costly than cases that are tried but not appealed. We caution that while these results are sensible, we cannot infer causation. Unobserved factors may drive both expenses and stage of resolution.

Med mal cases are more expensive to defend than other cases ($P = 0.0000$ using standard tests for both means and medians). Figure 5 also reflects median costs for our entire sample period, and thus understates the differences at the end of the sample period.

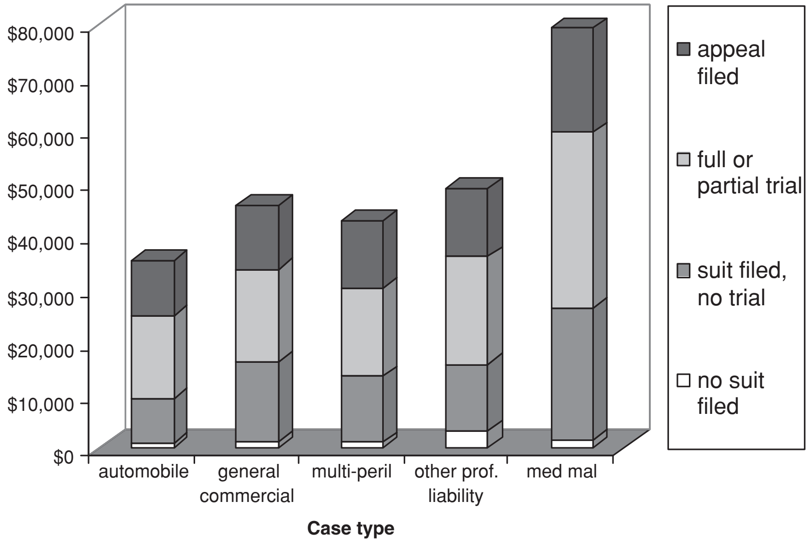

Figure 5. Defense costs by area and stage of resolution. Median defense costs for 64,246 nonduplicate closed claim reports in the TDI dataset of personal injury claims closed from 1988–2004 with positive defense costs and payout >$25,000 in 1988 dollars.

6.2. Factors Predicting Defense Costs across Areas: OLS Results

We turn next to regression analysis of the factors that predict defense costs across areas. Table 7 reports OLS results; we report 2SLS results in the next section. The regressions in table 7 are similar to table 3. Regressions (1–5) cover each area separately. Regression (6) includes all reports, with area dummy variables (general commercial is the omitted category) and an interaction term between med mal dummy and year. Panel A reports time trends with only ln(payout), defendant type dummies (for all twenty-six types in the dataset), and a constant term as independent variables. The coefficients on year are similar in unreported regressions, which do not control for ln(payout) or type of defendant.

Defense costs rise over time across all areas except other professional liability. In panel. A, the annual rate of increase ranges from 1.4 percent in general commercial cases to 2.5 percent in commercial multi-peril cases. The overall rise in defense costs in non-med-mal cases is 2.0 percent per year, compared to 4.5 percent in med mal cases. In regression (6), the

Table 7. All personal injury cases: factors predicting defense costs, OLS results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Ln(defense cost)					
Sample	Auto	General commercial	Multi-peril	Other professional liability	med mal	All cases
Panel A: Time trend and ln(payout)						
Year	**0.022**	**0.014**	**0.025**	0.006	**0.045**	**0.020**
	(10.73)***	**(5.90)*****	**(8.44)*****	**(0.69)**	**(21.00)*****	**(14.64)*****
med mal dummy * year						**0.025**
						(9.94)***
ln(payout)	**0.520**	**0.449**	**0.456**	**0.470**	**0.358**	**0.458**
	(55.55)***	**(49.27)*****	**(39.11)*****	**(10.88)*****	**(36.41)*****	**(92.64)*****
Area dummies	No	No	No	No	No	Yes
Defendant type dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Overall adj. R^2	0.1242	0.1705	0.161	0.1486	0.1209	0.2251
Panel B: Full controls						
Year	**0.028**	**0.031**	**0.033**	**0.033**	**0.050**	**0.030**
	(17.06)***	**(15.31)*****	**(13.82)*****	**(4.24)*****	**(30.45)*****	**(27.18)*****
med mal dummy * year						**0.018**
						(9.28)***
ln(payout)	**0.481**	**0.420**	**0.426**	**0.423**	**0.299**	**0.416**
	(62.60)***	**(50.84)*****	**(42.64)*****	**(11.85)*****	**(38.80)*****	**(100.19)*****

Dummy (suit filed)	**1.688**	**2.011**	**1.945**	**1.482**	**1.903**	**1.810**
	(62.34)*	**(34.28)***	**(31.72)***	**(7.66)***	**(35.50)***	**(87.88)***
Dummy (trial started)	**0.799**	**0.550**	**0.612**	**0.685**	**0.593**	**0.664**
	(25.18)*	**(16.01)***	**(13.70)***	**(4.31)***	**(19.02)***	**(38.28)***
Dummy appeal	0.046	0.144	−0.061	−0.104	0.083	0.048
	(0.50)	(1.84)*	(−0.53)	(−0.38)	(1.10)	(1.05)
Dummy multiple defendants	**0.391**	**0.417**	**0.433**	**0.229**	**0.259**	**0.390**
	(19.80)*	**(23.31)***	**(19.94)***	**(3.07)***	**(15.92)***	**(42.08)***
ln(days claim open)	**0.623**	**0.504**	**0.58**	**0.602**	**0.712**	**0.597**
	(39.57)*	**(28.85)***	**(27.62)***	**(10.26)***	**(40.21)***	**(68.86)***
Dummy med mal						**0.091**
						(2.18)
Dummy auto						**−0.536**
						(−40.95)*
Dummy multi-peril						**−0.074**
						(−5.31)*
Dummy other professional liability						**0.230**
						(4.47)*
Defendant type dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	24,107	15,614	9,897	896	13,730	64,244
Overall adj. R^2	0.4636	0.4107	0.458	0.4213	0.4988	0.5067

Regressions of ln(total defense cost per case) on indicated independent variables for 64,244 nonduplicate closed claim reports in the TDI dataset of personal injury claims closed from 1988–2004 with positive defense costs and payout > $25,000 in 1988 dollars. Defense cost is amount paid by the insurer filing the report. Payout is amount paid by the insurer, the primary defendant, and any excess insurer for that defendant. In regression (6), the omitted category is general commercial. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Significant results at 5% or better in **boldface**.

med-mal versus non-med-mal difference is captured by the 2.5 percent coefficient on the interaction between med mal dummy and year.

In table 7, panel B, we add a family of independent variables, similar to table 3 (we drop the full trial dummy, it is insignificant if included). The factors that predict defense costs are similar across areas. In regression (6), the rate of increase in defense costs in non-med-mal cases, conditioned on claim and resolution stage characteristics, is 3.0 percent per year, compared to the 2.0 percent rate in panel A. Defense costs still rise significantly faster in med mal cases, as indicated by the 1.8 percent coefficient on the interaction between med mal dummy and year.

6.3. Factors Predicting Defense Costs across Areas: 2SLS Results

The OLS results in table 7 are subject to the same endogeneity concern as for med mal cases. We address this concern in table 8, using the same instruments for payout that we used for med mal cases—ln(age + 1), baby dummy, and employed dummy. Unfortunately, these instruments are weaker predictors of payout for non-med-mal cases. Baby dummy is weak because, while baby cases are 11 percent of med mal cases, they are only 0.3 percent of other cases. Age is a weaker predictor as well. Elderly plaintiffs are 20 percent of med mal cases, but only 7 percent in other cases, so there is less spread in age range, which weakens ln(age + 1) as an instrument. Ln(age + 1) is still a significant predictor of defense costs for general commercial and multi-peril cases, but is insignificant for auto and other professional liability cases. On the other hand, endogeneity appears to be less of a concern for auto and other professional liability cases. In table 8, a Hausman test provides evidence of endogeneity (at 5 percent level) only for general commercial, multi-peril, and med mal cases.

We limit table 8 to cases with suit filed, for greater comparability to Hersch and Viscusi (2007). Results are similar if we include cases without suit filed, for all areas except auto.[25] We present only second-stage results to save space.[26] Our instruments pass a Hansen test (at 5 percent level), for

25. For auto cases, if we include claims settled prior to suit, the coefficient on instrumented ln(payout), in a regression similar to table 8, regression (1), is small and insignificant [0.070 ($t = 0.27$)].

26. The first stage regressions, and regressions including cases with no suit filed, are available from the authors on request.

Table 8. All personal injury cases: factors predicting defense costs, 2SLS results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Ln(defense cost)					
Sample	Auto	General commercial	Multi-peril	Other professional liability	med mal	All cases
Year	**0.025**	**0.023**	**0.031**	**0.027**	**0.047**	**0.027**
	(10.83)***	**(9.94)*****	**(11.61)*****	**(3.34)*****	**(27.45)*****	**(22.40)*****
med mal dummy * year						**0.019**
						(9.04)***
Exposure (instrumented ln(payout))	**0.860**	**0.929**	**0.806**	**0.608**	**0.632**	**0.748**
	(3.18)***	**(11.11)*****	**(7.78)*****	**(3.91)*****	**(12.01)*****	**(17.34)*****
Dummy (trial started)	**0.680**	**0.289**	**0.447**	**0.591**	**0.448**	**0.525**
	(7.72)***	**(4.79)*****	**(6.83)*****	**(3.68)*****	**(10.67)*****	**(20.08)*****
Dummy appeal	−0.250	−0.099	**−0.376**	−0.314	−0.180	**−0.186**
	(−1.06)	(−0.93)	**(−2.37)****	−(0.92)	(−1.78)*	**(−3.12)*****
Dummy multiple defendants	**0.397**	**0.536**	**0.505**	**0.311**	**0.237**	**0.412**
	(17.80)***	**(18.74)*****	**(16.03)*****	**(4.28)*****	**(13.51)*****	**(38.73)*****
ln(days claim open)	**0.742**	**0.454**	**0.557**	**0.553**	**0.741**	**0.621**
	(12.10)***	**(21.90)*****	**(24.98)*****	**(9.29)*****	**(40.11)*****	**(64.45)*****
Dummy med mal						−0.002
						(−0.04)
Dummy auto						**−0.557**
						(−40.73)***
Dummy multi-peril						**−0.050**
						(−3.34)***

(*continued overleaf*)

Table 8. (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Ln(defense cost)					
Sample	Auto	General commercial	Multi-peril	Other professional liability	med mal	All cases
Dummy other professional liability						**0.160**
						(2.85)***
Defendant type dummies	yes	yes	yes	yes	yes	yes
Constant	yes	yes	yes	yes	yes	yes
Sample size	20,070	14,680	9,186	844	12,928	57,708
Overall adj. R^2	0.153	0.042	0.170	0.245	0.191	0.261
Endogeneity tests (*P* value)						
χ^2 for endogeneity	2.6	49	18	1.37	54	74
	(0.11)	(0.0000)	(0.0000)	(0.24)	(0.0000)	(0.0000)
Hansen χ^2	0.09	6.80	15	0.85	1.46	12
Hansen χ^2	(0.95)	(0.033)	(0.0006)	(0.65)	(0.46)	(0.003)

Two-stage least squares regressions of ln(defense cost) on indicated independent variables for 57,708 nonduplicate closed claim reports in the TDI dataset of personal injury claims closed from 1988–2004 with a lawsuit filed, positive defense costs, and payout >$25,000 in 1988 dollars. First stage is omitted. Instruments for ln(payout) are ln(age + 1), baby dummy, and employed dummy. Defense cost is amount paid by the insurer filing the report. Payout is amount paid by the insurer, the primary defendant, and any excess insurer for that defendant. In regression (6), the omitted category is general commercial. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Significant results at 5% or better in **boldface**.

med mal, other professional liability, and auto, and nearly do so for general commercial ($P = 0.03$), but not for multi-peril.

The Hansen test results merit some explanation. This test regresses the residuals from the second stage on all instruments and all other (assumed exogenous) variables. If the instruments predict the dependent variable *only* through the instrumented variable, the R^2 from this regression should be zero. For large sample sizes, the Hansen test can reject instrument validity if the instruments directly predict the dependent variable even slightly. For n instruments and a single instrumented variable, the Hansen χ^2 has $n - 1$ degrees of freedom, and equals (sample size)*(R^2 from this regression). The 5 percent critical value with 2 degrees of freedom is 5.99. For a sample size of 10,000, one reaches this critical value with an R^2 of only 0.0006. Perhaps unsurprisingly, the Hansen results are sensitive to specification. For example, in table 8, if we include cases with no suit filed, the instruments pass a Hansen test for multi-peril, but no longer do so for general commercial.

Compared to the OLS results in table 7, the coefficients on year are slightly lower, but remain significant and positive across areas, and average 2.7 percent for other areas, compared to 4.7 percent for med mal. The coefficients on ln(payout) are higher than in OLS, as expected, and are roughly comparable across areas.

For med mal cases, multidefendant dummy was significant in OLS (table 3), but insignificant in 2SLS (table 4). In contrast, this dummy has a higher coefficient in table 7 than in table 3 for med mal cases, and remains significant in 2SLS in table 8 across areas, with coefficients similar to table 7. For med mal cases, these differences arise because we sum across duplicate reports in tables 3 and tables 4, but not in 7 and table 8 (for comparability with other areas, where we lack the data to do so). In the first stage in 4, multidefendant dummy strongly predicts higher defense cost. In the unreported first stage for table 8, this dummy is an insignificant predictor of defense cost.

One natural explanation is as follows: The defendants agree on who will take the lead in defending the case, and defense spending reflects the total exposure of all defendants. Once that total exposure is controlled for (in table 4, but not in table 8), multidefendant dummy does not separately predict higher defense spending. If so, the positive coefficient on multidefendant dummy in table 8 could be spurious. We lack the data to assess whether the positive coefficients on multidefendant dummy for other types of cases are also spurious.

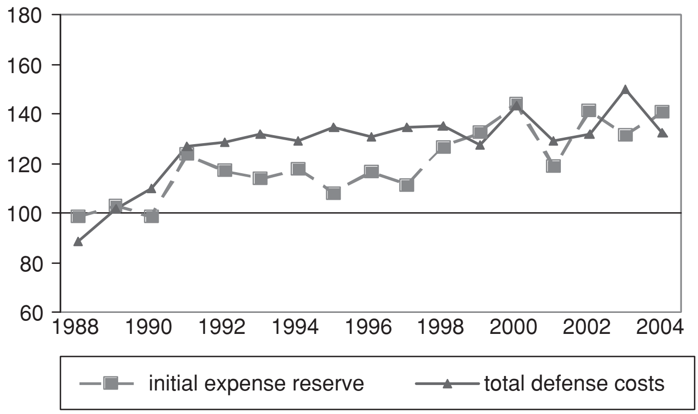

Figure 6. Non-med mal cases: normalized mean defense costs and initial reserves. Figure shows: (i) mean per case initial expense reserve for each year, and (ii) mean per claim defense costs, in each case normalized to 100 over 1988–1990, for 63,251 non-medical-malpractice claim reports (including duplicate reports) in the TDI dataset of personal injury claims closed from 1988–2004 with payout >$25,000 in 1988 dollars.

As we did for med mal cases in Section 4, we conduct robustness checks with alternate instruments. Ln(policy limits) easily passes a difference-in-Hansen test for instrument validity for all types of cases other than med mal. If we add it as an additional instrument (and, for multi-peril cases, remove employed dummy which fails a difference-in-Hansen test for these cases, and drives the Hansen χ^2 of 15 for these cases), then (i) auto cases show strong endogeneity, now that we have a stronger instrument; (ii) we obtain acceptable Hansen χ^2 values for each type of case(ranging from 0.2 ($p = 0.98$) to 6.9 ($p = 0.07$); and (iii) coefficients on exposure are similar for general commercial and other professional liability, but drop to 0.779 ($t = 17.81$) for auto cases and 0.667 for multi-peril cases.

6.4. Expense Reserves in Non-Medical Malpractice Cases

We saw in Section 5 that med mal insurers did not adjust their expense reserves to reflect increasing defense costs. Figure 6 provides evidence that insurers in other lines *did* update their reserves as defense costs rose. Figure 6 is structurally similar to figure 4. It shows mean per case defense costs and initial reserves for non-med mal cases by year, normalized to their

Table 9. All personal injury cases: insurer reserves over time

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Ln(expense reserve/indemnity reserve)				
Sample	Auto	General commercial	Multi-peril	Other professional liability	med mal
Year	**0.009**	**0.005**	**0.008**	0.011	**−0.020**
	(4.52)***	**(2.17)****	**(2.53)****	(1.43)	**(−12.81)*****
ln(indemnity reserve)	**−0.638**	**−0.557**	**−0.638**	**−0.656**	**−0.622**
	(−92.37)***	**(−71.56)*****	**(−56.54)*****	**(−17.95)*****	**(−100.3)*****
Constant	4.907	4.598	5.308	5.48	5.267
	(67.09)	(57.31)	(46.59)	(16.15)	(80.45)
Sample size	7,093	6,747	3,351	520	12,334
Overall adj. R^2	0.5591	0.4743	0.5225	0.4654	0.4487
Cuzick test for trend	**6.13*****	**6.04*****	**1.97****	**−1.96****	**−9.90*****
(P-value)	(0.0000)	(0.0000)	(0.049)	(0.050)	(0.0000)

Regressions of ln(expense reserve/ indemnity reserves), for 30,045 closed claim reports (including duplicate reports) in the in the TDI dataset of personal injury claims closed from 1988–2004 with positive expense reserves, positive indemnity reserves, and payout >$25,000 in 1988 dollars. excluding cases with (i) expense reserve = defense cost; (ii) (indemnity reserve = payout but ≠ policy limits); or (iii) indemnity reserve or expense reserve <$1,000, or ratio of expense reserve/indemnity reserve <0.02 or >50. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Cuzick test statistic is a z-statistic. Significant results at 5% or better in **boldface**.

respective means during 1988–1990. Defense costs and reserves rise, roughly in parallel. Reserves fall somewhat behind expenses for closed claims during 1992–1997, as insurers reduce per case reserves while expenses gradually rise. But initial reserves catch up in 1998–2000, and remain similar to expenses thereafter.

Insurers' rising expense reserves in non-med-mal cases do not simply reflect rising indemnity reserves, plus a roughly constant ratio of expense reserves to indemnity reserves. Instead, the ratio of expense reserves to indemnity reserves rises over time. Table 9 shows the time trends in this ratio, controlling for indemnity reserve. This ratio rises for auto general commercial and multi-peril cases, and is insignificant for other professional liability, yet falls in med mal. This only deepens the puzzle: Med mal insurers face the fastest rise in defense costs. Why then do insurers in other lines adjust their expense reserves, while med mal insurers do not?

Initial expense reserves do better at predicting case-level variation in defense costs for cases that do not involve professional liability. The adjusted R^2 for a simple regression of ln(defense cost) on ln(expense reserve) plus a constant term is 0.112 for general commercial, 0.088 for auto, and 0.085 for commercial multi-peril, compared to 0.027 for other professional liability and only 0.014 in med mal cases (see table 5). It is unclear whether this is because insurers in non-professional liability cases were objectively better at predicting expenses, expenses were more predictable in these cases, or both.

6.5. Use of Inside versus Outside Counsel

Across all types of cases, the vast majority of spending on counsel goes for outside counsel. For med mal, we saw above that one insurer experimented with using inside counsel, but abandoned the experiment. For other types of cases, outside counsel cost ranges from 94 percent of total counsel cost in multi-peril cases to 96.5 percent in general commercial cases (see table 2, panel C). As was the case for med mal, insurers generally do not use inside counsel to monitor outside counsel—the fraction of claims with positive expense for both inside and outside counsel is low, ranging from 1.3 percent (other professional liability) to 3.7 percent (multi-peril).

Non-med mal cases show a time trend toward greater use of inside counsel. However, the economic significance of this trend is limited. The marginal effects estimate from a probit regression with area dummy variables is 0.22 percent per year ($t = 7.71$).

Hersch and Viscusi (2007) argue that insurers tend to send more complex and larger cases to outside counsel. This claim is not supported for med mal cases; instead insurers almost invariably use outside counsel, the abandoned experiment by one insurer aside. In other areas, bigger cases (proxied by indemnity reserve) are indeed less likely to go to inside counsel. As figure 7 shows, the probability of using inside counsel falls from 15 percent to 4 percent as ln(indemnity reserve) increases from 7 to 14 ($1,000 to roughly $1 million). The probability of using both types of counsel is roughly constant, at about 4 percent. Med mal aside, the trend toward using outside counsel in larger cases is similar across all types of cases.

6.6. Trial Rates

Across all areas, large paid claims tried to verdict vary only moderately as a percentage of large paid claims. Percentages range from 2.7 percent (auto and med mal) to 3.6 percent (other professional liability) (see table 2, panel B, last row). However, there are larger differences in trial rates as a

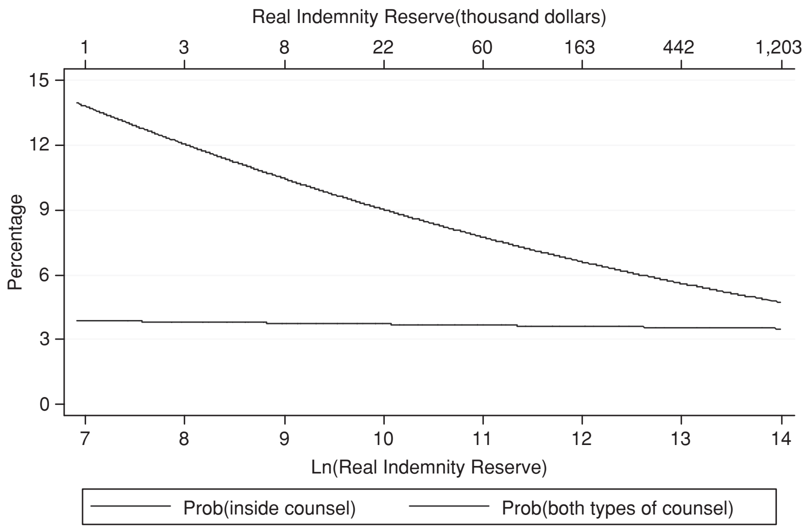

Figure 7. Non-med-mal cases: probability of using inside counsel. Probability of using inside counsel, and both inside and outside counsel, for 47,250 non-med-mal claim reports (including duplicate reports) in the TDI dataset of personal injury claims closed from 1988–2004 with a lawsuit filed, payout >$25,000, and indemnity reserve ≥$1000 in 1988 dollars. Lines are based on probit regressions of probability of using outside counsel only, inside counsel only, or both types of counsel; independent variables are ln(indemnity reserve), ln(policy limits), multiple defendant dummy, baby dummy, type of injury dummies, type of defendant dummies, area dummies, and constant term. Marginal effects coefficient on ln(indemnity reserve) in inside counsel regression is –0.009 ($t = 6.07$).

percentage of all claims. We lack data on the number of defense verdicts, but we can estimate the trial rate by assuming that:

- If the plaintiff wins at trial, the likelihood that the payout will be $10,000 (nominal) or more is close to 1. This is because small cases are unlikely to go to trial.

Under these assumptions, the trial rate equals the observed ratio of plaintiff trial wins to total claims, divided by the unobserved plaintiff success rate at trial:

$$Trial\ rate = \frac{\left(\frac{\text{Trial wins}}{\text{Observed wins}}\right)\left(\frac{\text{Observed wins}}{\text{Total claims}}\right)}{\left(\frac{\text{Plaintiff wins}}{\text{Trials}}\right)} \approx \frac{\left(\frac{\text{Trial wins}}{\text{Total claims}}\right)}{\left(\frac{\text{Plaintiff wins}}{\text{Trials}}\right)}$$

Table 10. Estimated trial rates over 1995–2004

	(1)	(2)	(3)	(4)	(5)
Line of insurance	Auto	General commercial	Multi-peril	Other professional liability	Med professional liability
Total claims	544,640	435,593	190,236	19,816	77,575
Plaintiff trial wins (payout > $10,000 (nominal)	692	260	211	20	209
Trial wins/ total claims	0.13%	0.06%	0.11%	0.10%	0.27%
Assumed plaintiff win rate	0.50	0.50	0.50	0.25	0.25
Estimated trial rate	0.25%	0.12%	0.22%	0.40%	1.08%

Summary data for all personal injury claims (including duplicate claims) and nonduplicate plaintiff trial wins with payout >$10,000 (nominal), closed from 1995–2004, included in the TDI dataset of personal injury claims and insurers' annual aggregate insurer reports. For trial wins, duplicate reports are identified by us (TDI) for med mal (other) cases. For total claims, number of duplicate reports is not available. Claims are classified based on line of insurance.

We can estimate the denominator, based on other studies, at roughly 0.25 for med mal and other professional liability, and 0.50 for other areas.[27]

Table 10 shows the numerator, the assumed denominator, and the estimated trial rate for 1995–2004. Trials are uncommon even in med mal cases, but are significantly more common for med mal than for other areas (t-statistic for difference in proportions $= 4.14$). The higher med mal trial rates contribute directly to higher defense costs. They may also contribute indirectly, by influencing behavior in cases that are later settled.

The trial rate would be somewhat higher if the denominator were lawsuits, rather than claims. However, we do not have data on the total number of lawsuits. Still, our estimated med mal trial rate is dramatically lower than the 15 percent rate found by Studdert *et al.* (2006). We have no good explanation for this difference.

27. For med mal cases, see Cohen (2004) (plaintiff win rates for 1992, 1996, and 2001 surveys ranged from 22–30 percent, with mean of 27 percent); Studdert *et al.* (2006) (21 percent plaintiff win rate). For state tort trials generally, see Cohen and Smith (2004) (51 percent overall plaintiff win rate in jury trials, which implies a roughly 55 percent win rate in non-med-mal cases).

7. Six Factors That Might Explain Rising Defense Costs—but Don't

Why are defense costs rising in med mal cases? Consistent with the model of defense costs we presented earlier, there are six plausible possibilities that we can at least partly test:

- Hourly legal fees might be increasing;
- Payouts might be rising;
- Exposure might be rising, even if payouts are not;
- Insurers might be spending more in order to win a larger fraction of cases;
- Cases might be taking longer to close; and
- Cases might be resolved at a later procedural stage.

We examine each of these possibilities in turn.

7.1. Defense Counsel Hourly Rates

Outside counsel expense is the largest component of defense cost. In a simple model, outside counsel expense equals hourly rate *hours spent. The TCCD contains no information on either subject, but we are able to obtain data on hourly fees from periodic surveys conducted by the Texas State Bar of hourly rates charged by attorneys during 1988–2005. We have median fees for all six iterations of the survey, and mean fees for some iterations, for both personal injury defense counsel and all counsel. Some caveats: The survey design changed over time, so results for different years may not be comparable. We have no case-level data on hourly rates, or how case characteristics affect choice of counsel (beyond the basic decision to use inside or outside counsel). We have only statewide data on billing rates, and no data on alternative billing arrangements.

Table 11 reports mean and median hourly rates for personal injury defense counsel and all counsel, for the six survey years. Real hourly rates for personal injury defense counsel fluctuated, but ended up almost unchanged in 2005 versus 1989. Thus, it does not appear that a rise in hourly rates explains the rise in defense counsel cost. There could, of course, be a divergence over time between the hourly rates reported on the Texas bar survey and the blended average rates paid by insurers, or between rates charged by med mal defense counsel and other personal injury defense

Table 11. Defense counsel hourly rates

	Personal injury defense counsel			All counsel		
Year	Median	Mean	Sample	Median	Mean	Sample
1989	104.9			111.6		1, 389
1994	111.8	111.0	292	111.8	116.5	4, 186
1996	94.3	103.3	478	113.1	116.1	2, 300
2000	103.1	100.3	22	120.2	135.3	1, 038
2003	96.4		45	128.6	144.0	2, 705
2005	106.0	107.2	37	130.2	141.7	2, 414
Annual increase	0.06%	−0.31%		0.97%	1.80%	
Period covered	1989–2005	1994–2005		1989–2005	1994–2005	

Median and mean hourly fees charged by personal injury defense counsel, and all counsel, for indicated years, in 1988 dollars. Data are from Texas State Bar surveys for indicated years.

counsel. But there is no obvious reason to expect either source of divergence, and it seems unlikely that any divergence can explain more than a fraction of the increase in defense costs. This leaves more hours worked as a likely source of much or all the increase in counsel fees.

Table 11 also shows mean and median rates for all respondents. The all-respondents series is less noisy due to larger sample size, but likely less representative of personal injury defense counsel. It shows an increase in median fees of about 1 percent per year from 1989–2005. Even if this increase also applied to personal injury defense counsel, it would explain only a fraction of the rise in med mal counsel costs.

7.2. Payouts

Higher payouts predict higher defense costs, so if payouts increase over time, defense costs should increase as well. In Black *et al.*, *Stability, Not Crisis* (2005), we found that per claim payouts were roughly constant over 1988–2002. In unreported regressions, we extend this analysis through 2004. In a regression of ln(payout) versus year and constant term, year has an insignificant coefficient of 0.23 percent per year ($t = 1.15$). Thus, rising payouts do not explain rising defense costs.

7.3. Exposure

Defense costs and payout are endogenous. A possible explanation for why defense costs are rising, but payouts are not, is that exposure is rising, and that payouts would have risen if insurers had not increased their defense spending. We have limited ability to test this hypothesis, but can say the following. First, in unreported regressions, we run a first stage regression with ln(payout) as dependent variable, and various combinations of year, our instruments, ln(policy limits), type of defendant dummies, and type of harm dummies as independent variables. We then test whether the predicted payout from the first stage, which is a measure of exposure, has a time trend. It does not.

Second, policy limits provide a measure of maximum exposure. If limits were rising, this could predict rising defense costs. However, we find no significant time trend in policy limits. Limits decline over time for physicians (consistent with Zeiler *et al.*, *Policy Limits*, [2007]) and for nursing homes, but rise for hospitals.

7.4. Fraction of Paid Claims

More vigorous defense of claims could lead to a smaller fraction being paid. In unreported regressions, we find no time trend in the fraction of claims over 1995–2004 (the period for which we have data on total claims) which result in payouts of $25,000 or more. Consistent with Black *et al.*, *Stability, Not Crisis* (2005), the fraction of smaller paid claims (from $10k to $25k) declines. This is consistent with some smaller cases being dropped due to rising costs to bring them. Compare Vidmar *et al.* (2005) (rising injury severity over time for Florida med mal cases).

7.5. Claim Duration

Longer claim duration predicts higher defense spending. Thus, rising duration could explain rising defense costs. In table 12, we regress duration against year, ln(payout), multidefendant dummy, and constant term, for each personal injury area. Med mal cases have been closing more quickly over time. Mean (median) days open dropped from 1,029 (912) over 1988–1992 to 888 (781) over 2000–2004. One major Texas med mal insurer advised us that they sought aggressively to close cases more quickly during the 1990s, having observed that doing so reduced defense costs and did not increase payouts.

One might expect that larger cases, and perhaps more complex cases (holding exposure constant) will take longer to resolve. Table 12 provides evidence consistent with larger cases taking longer to resolve. Within each

Table 12. Claim duration: all types of personal injury cases

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Duration (ln(days claim open))				
Sample	Auto	General commercial	Multi-peril	Other professional liability	med mal
Year	**0.002**	**−0.007**	0.0005	**−0.027**	**−0.006**
	(2.28)**	**(−6.50)*****	(0.33)	**(−5.23)*****	**(−5.12)*****
ln(payout)	**0.043**	**0.056**	**0.065**	**0.065**	**0.027**
	(11.34)***	**(12.74)*****	**(11.05)*****	**(2.92)*****	**(5.33)*****
Multidefendant dummy	**0.134**	**0.115**	**0.152**	**0.230**	**0.174**
	(13.53)***	**(11.72)*****	**(12.34)*****	**(4.96)*****	**(15.64)*****
Constant	6.019	6.103	5.825	5.954	6.28
	(139.2)	(119.5)	(86.1)	(23.4)	(102.0)
Sample size	31,933	17,592	11,594	972	14,241
Overall adj. R^2	0.0103	0.0191	0.0223	0.0581	0.0222
Cuzick test for trend	0.97	**−10.17*****	−0.78	**−5.99*****	**−7.85*****
(*P* value)	(0.333)	**(0.0000)**	(0.428)	**(0.0000)**	**(0.000)**

Regressions of ln(days claim open) on year, ln(payout) and constant term for 76,332 nonduplicate closed claim reports in the TDI dataset of personal injury claims closed from 1988–2004 with payout >$25,000 in 1988 dollars. Payout is amount paid by the insurer, the primary defendant, and any excess insurer for that defendant. All regressions use 1988 dollars, county fixed effects, and White's heteroskedasticity-consistent standard errors. *, **, *** indicates significance at the 10%, 5%, and 1% levels, respectively (suppressed for constant term). Cuzick test statistic is a *z*-statistic. Significant results at 5% or better in **boldface**.

area, the coefficients on ln(payout) and multidefendant dummy are consistently positive and significant.

However, across different types of cases, we do not find a clear relationship between complexity (proxied by presence of multiple defendants), exposure, and case duration. Med mal cases involve larger payouts and are more likely than other cases to involve multiple defendants, yet they do not take longer to resolve than general commercial and multi-peril cases (see table 2). Auto cases are the simplest and lowest-payout area, yet are resolved only slightly faster.

7.6. Stage of Resolution

Defense costs rise if a suit is filed, and rise again if a case goes to trial (see figure 5). Thus, a higher proportion of claims in our dataset resulting in suits, trials, or both, could produce rising defense costs. In unreported regressions, we find a modest increase in the fraction of med mal claims resolved after suit was filed, and no change in the fraction that involved a full trial. However, the rate of increase in defense costs in med mal cases is similar whether we limit to cases with suit filed (tables 7 and tables 8) or include all cases (3 and 4).

8. Discussion

We discuss below some implications of our results, focusing on med mal cases.

8.1. Rising Defense Costs Over Time

We find a strong trend over time toward higher defense costs. The rate of increase is stronger for med mal than for other types of personal injury cases, but is present across types of cases. Over 1988–2004, real defense costs in med mal cases more than doubled, while defense costs in other types of cases rose by about 40 percent.

Focusing on med mal cases, we can largely rule out a number of possible causes of the rise in defense costs (see Section 7). Several other explanations for increasing defense costs are possible. Plaintiffs' attorneys may have selected stronger cases over time or invested more resources in case development, forcing insurers to respond. Two additional explanations are specific to Texas. Texas adopted legislation in 1987 to encourage counties to adopt ADR, and in 1995 to restrict who could be an expert in a med mal case. In unreported regressions we find a substantial increase in the percentage of cases resolved with ADR. One or both of these changes may have increased defense costs.

Evidence from other states on time trends is mixed (see Section 2). The sustained rise in defense costs deserves further attention from researchers and policymakers. We know of no significant academic or public discussion of time trends in defense costs. Some insurers have complained about rising defense costs, but have offered no data and have blamed runaway tort awards. In Texas, that explanation lacks empirical support. If the rise in defense costs reflects a national trend, we need to understand the root causes. If it is limited to some states, we need to understand the factors that cause the differences in state trends.

8.2. Insurer Reserves for Medical Malpractice Defense Costs

Perhaps our most surprising finding is on med mal insurers' reserves for defense costs. Per case defense costs for these cases doubled over our sample period, both in dollars and as a percentage of payout, yet per case reserves were *lower* at the end of the period than at the beginning. In contrast, per case reserves in other areas kept pace with the increase in defense costs.

Med mal insurers do not appear to use a rule of thumb for ratio of expense reserve to indemnity reserve when setting expense reserves in individual cases, but they may still do so when setting overall expense reserve guidelines. Such a pattern, plus failure to update the (overall adequacy) rule of thumb, could help to explain the failure of med mal insurers to raise expense reserves even as defense costs rose. However, this still would not explain why med mal insurers *reduced* their per case expense reserves over time.

Defense costs are a significant portion of med mal insurers' costs. By 2004, average defense spending for the large paid claims in our sample was roughly 18 percent of payouts. In other studies, which have data on defense costs in zero-payout cases, defense costs in these cases are roughly 40–45 percent of total defense cost.[28] If we add a bit for defense costs in low-payout cases, a reasonable estimate is that we do not observe 45 percent of total defense costs. If so, total defense costs would be roughly 33 percent of total payouts and roughly 25 percent of the sum of total payouts plus total defense costs.

The failure of med mal insurers to adjust their reserve estimates to reflect rising defense costs suggests remarkable inattention to a central aspect of their business—reserving accurately for defense costs. A business adage states that "you manage what you measure." For at least some Texas med mal insurers, this should perhaps be modified to "you manage what you notice."

8.3. The Efficiency of Medical Malpractice Litigation

The tort system is an expensive way to transfer resources from defendants to plaintiffs. Our findings provide information on how expensive the system

28. In Studdert *et al.* (2006), 40 percent of defense costs ($30M out of $76M) were incurred in zero-payout cases over 1984–2004. They exclude cases with defense spending <$2,000 from their sample. In State of Washington (2005), 46 percent of defense costs were incurred in cases with zero payout over 2000–2004. In Connecticut Insurance Department (2007), 38 percent of defense costs were incurred in zero-payout cases over 2005–2006. In Danzon (Munch) (1977), 46 percent of defense costs over 1975–1976 were incurred in zero-payout cases.

is. We estimated above that total defense costs likely equal about 33 percent of observed payouts. If we assume that the median plaintiff's legal fees and expenses are 35 percent of the indemnity payout, then the per case efficiency of the system is a bit under 50 percent.[29] Stated differently, it costs a bit over a dollar in legal fees and expenses for the plaintiff to end up with $1 in his pocket.

Insurers also have administrative and other overhead costs, and some defendants may not report their expenses to TDI. If we assume that insurers' overhead costs are 15 percent of payouts plus defense costs,[30] per case efficiency including these costs will be on the order of 42 percent.

8.4. The Choice Between Inside and Outside Counsel

Insurers' choice between outside counsel and staff counsel reflects a standard "make or buy" decision about the boundaries of the firm. Rising defense costs or other changes in the legal environment might provide the impetus for insurers to rethink these choices.

Despite steadily increasing legal expenses, we find no evidence that med mal insurers are moving toward using inside (staff) counsel. The two largest physician insurers of physicians advised us that they never use inside counsel, and the one insurer that switched in the 1980s to inside counsel later switched back. At least in Texas, med mal insurers do not see inside counsel as offering a solution to rising defense costs.

The picture is less clear for other areas. Although outside counsel are responsible for the overwhelming majority of spending across all areas, there is a tendency to use inside counsel more often in smaller cases (proxied by ln(indemnity reserve)) and a modest trend toward increased use of inside counsel.

29. Studdert *et al.* (2006) estimate plaintiff's legal fees and expenses at 35 percent of indemnity payouts. Similar estimates, which assume plaintiffs' counsel charge a 33 percent contingency fee, and then add a bit for expenses, are common. See, e.g., Brickman (2003). We are currently studying plaintiff-side legal fees and expenses in med mal and other personal injury litigation. Our preliminary results indicate that for med mal, 35 percent is conservative. Per case efficiency is defined as follows: (indemnity payout – plaintiff's legal fees)/(indemnity payout + defense costs). In the example in the text, this equals $(1 - 0.35)/(1 + 0.30)$, or $0.65/1.30 = 0.50$.

30. Kessler (2006) estimates these costs at 14.3 percent of incurred costs for indemnity and expenses.

8.5. What Can We Learn From Changes in Malpractice Premiums?

Texas malpractice insurers more than doubled their rates during 1999–2003. Insurers, physicians, and legislators blamed the tort system and out-of-control juries, and pushed for tort reform. Texas ultimately adopted a cap on non-economic damages in med mal cases of $250,000 (nominal), plus other reforms intended to discourage these claims. In Black *et al.*, *Stability, Not Crisis* (2005), we found that payouts per large paid claim and the number of large paid claims were stable during 1988–2002. In research for this article, with two more years of data, we find the same results.[31] Indemnity reserves as a fraction of payouts fluctuated, but gently (see figure 3). Adjusting for population growth, the number of large paid claims was stable and the number of smaller paid claims declined. Defense costs rose and the ratio of expense reserves to defense costs declined, but the growth in defense spending was gradual—not the stuff an insurance crisis is made of. Finally, in Hyman *et al.*, *Jury Verdicts* (2007), we found no evidence of dramatic changes in jury trial outcomes during 1988–2004.

The implication is that policymakers should not treat changes in med mal insurance premiums as reliable signals of changes in the litigation environment. In the long run, insurer costs surely predict premiums. But the long run may be rather long, and insurance cycle swings along the way can be large and only loosely connected to cost trends. The 2003 Texas tort reforms were a reaction to the rate spike, and claims by insurers and physicians that the rate spike reflected large increases in med mal exposure. In fact, based on closed claim data through 2004 (well after rates soared in 1999–2000), the rate spike far exceeded what one can explain based on changes in the number of new claims or in per claim payout experience.[32]

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31. *See also* Texas State Board of Insurance (1987) (finding no strong time trend in payouts from 1983–1986, covering the previous medical malpractice insurance crisis). Due to different criteria for which claims were reported, we cannot combine the 1983–1986 results with those for 1988–2004, to estimate a time trend for the full period.

32. Insurers may have raised premiums partly in response to a modest rise in per claim payouts in 1999 and 2000. Per claim payouts by the primary insurer rose in 1999 and 2000 (and then largely subsided by 2001), but this rise—perhaps 15–20 percent relative to a multiyear average—cannot explain a doubling of rates. And if this rise prompted rate increases, the downtick in 2001 should have prompted decreases. Instead, insurance rates continued to rise sharply in 2002 and 2003. There was also a gradual decline in the ratio of indemnity reserves/payout over roughly 1993–2000 (see figure 3). But this decline is

8.6. Defense Cost Reserves and the Insurance Cycle

We study here defense costs and expense reserves; we do not study indemnity reserves (we are studying indemnity reserves in a separate project). We have data on defense costs only for large paid claims, and thus cannot directly assess the adequacy of expense reserves to cover defense costs for all claims. However, insurers' failure to carefully track changes in an important source of overall cost could contribute to an "insurance cycle" in med mal premiums. In such a cycle, insurers underprice in "soft" markets; then something (perhaps losses in this or another line of insurance, investment returns, or other factors) shocks the market; insurers raise rates to above-equilibrium levels (a "hard" market); insurers then compete their way down to underpricing again; the next shock strikes, and the cycle repeats. The failure by med mal insurers to adjust their expense reserves is consistent with conventional accounts of the insurance cycle. Baker (2005) offers reasons why the insurance cycle might be especially severe for med mal.

8.7. The Efficiency of Med Mal Litigation

The sustained rise in defense costs deserves attention from researchers and policymakers. It implies that our tort system, never a model of efficiency in providing compensation to injured persons, has become worse at this task over time. To be sure, the optimal level of spending on litigation is not known, and higher spending might produce more accurate outcomes or greater care (and hence fewer injuries) (Silver, 2002). Still, system efficiency (the fraction of defendant spending that ends up in the hands of plaintiffs) is one important measure of tort system performance, and the rise in med mal defense costs has thus far escaped public notice. We know of no significant academic or public discussion of this trend. Some med mal insurers have complained about rising defense costs, but have offered no data and have pointed the finger of blame at runaway tort awards. In Texas, at least, that explanation won't fly. We have also found no evidence for most of the other obvious causes of increased defense costs. Further research will be

not nearly large enough to explain the doubling of premiums over 1999–2003, much of it predates the rise in premiums, and it is itself puzzling. In unreported regressions, we find that payout per claim rose by 1.2 percent per year over 1993–2000, while indemnity reserves *fell* by 0.5 percent per year. This pattern is at least as consistent with an insurance cycle explanation for the dramatic rise in premiums that began in 1999 as an expense-driven explanation.

necessary to determine why costs are increasing so rapidly for med mal cases, and also, though less rapidly, for other personal injury cases. One possibility is the role of past tort reforms, including requirements for ADR and for early delivery of an expert report, in driving these increases.

One obvious strategy for increasing the efficiency of the tort system is to resolve cases more quickly, and at an earlier stage of litigation. Early offers of settlement are one possible way to speed early resolution. However, based on preliminary analysis of Texas data, we doubt that early settlement offers will produce savings anywhere close to the magnitude suggested by their proponents (see, for example, Hersch, O'Connell, and Viscusi, 2008). Programs that combine early disclosure and apology are another avenue that should be explored, although increases in the number of claimants may swamp the potential savings in litigation transaction costs (see Studdert *et al.*, 2007).

9. Conclusion

We have explored the factors that influence per case defense costs in med mal and other personal injury cases, both in OLS and in 2SLS (instrumenting for payout). We found a steady rise in defense costs across all types of cases, with the highest increase in med mal cases, where defense costs more than doubled over our sample period. Defense costs are higher in cases with suit filed, which go to trial, have larger exposure and last longer. Med mal insurers failed to adjust their reserving practices to reflect the rise in defense costs, in contrast to insurers in other areas.

The reasons for rising defense costs are unclear. We find no evidence to support a number of possible explanations, including rising payouts, rising exposure, rising lawyer hourly rates, claims staying open longer, and cases settling at a later stage. Regardless of the cause, higher defense costs imply that the fraction of total defendant spending that plaintiffs receive has declined over time.

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